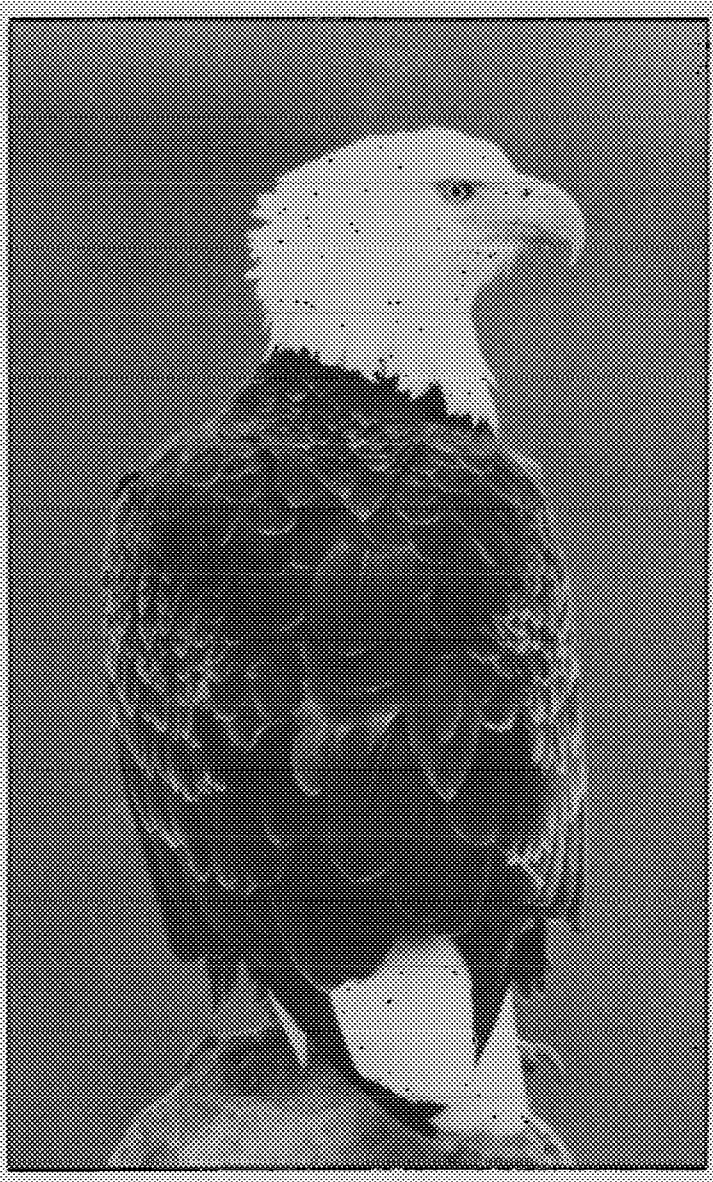
1986 Fish & Wildlife Annual Project Summary



Mission Statement

Bonneville will act as a catalyst for defining and achieving the electric power and conservation objectives of the Pacific Northwest. We will work to assure the region an adequate, economical, reliable, efficient, and environmentally acceptable power supply. We will do so in an open and businesslike way, consistent with our responsibilities to fish and wildlife and with our obligations as a Federal agency, and responsive to citizens' concerns for their well-being and the quality of their environment. Bonneville will provide leadership in the region, fulfilling our responsibilities with professional excellence.

Bonneville Power Administration
September 1983

This summary presents results, both preliminary and final, of projects funded by Bonneville Power Administration (Bonneville), U.S. Department of Energy. Such projects protect, mitigate, and enhance fish and wildlife resources affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. Findings and recommendations offered in these reports are those currently expressed by the contractors and do not necessarily represent the views of Bonneville.

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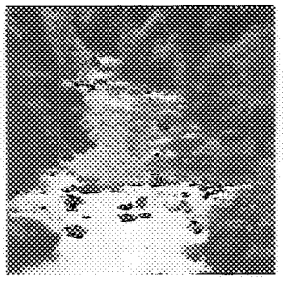


A Message from the Administrator

Fiscal 1986 was a year of measurable accomplishments to protect, mitigate, and enhance fish and wildlife resources harmed by hydroelectric development in the Columbia River Basin.

Contractors completed some 35 construction projects during the year, including important fish passage facilities and stream rehabilitation programs in Oregon, Idaho, and Washington. Opening up previously unused habitat in Columbia Basin tributaries will contribute substantially to salmon and steelhead populations and help offset past losses at the dams.

The Northwest Power Planning Council's Columbia Basin Fish and Wildlife Program, as amended in 1984, defines the major areas of concern and guides the combined efforts of many agencies. These include the Federal Energy Regulatory Commission, U.S. Army Corps of Engineers, Bureau of Land Management, and U.S. Forest Service. They also include the U.S. Fish and Wildlife Service, National Marine Fisheries Service, state fish and wildlife agencies, Indian tribes in four states, and volunteer organizations.

Under the Pacific Northwest Power Act, Bonneville is empowered to use its legal and financial resources to rebuild depleted fish and wildlife populations. Of the 250 specific measures in the Council's Fish and Wildlife Program, Bonneville is responsible for carrying out about one-half.

This annual report includes brief descriptions of all major Bonneville-funded projects worked on during the year. They are grouped under three general headings: salmon and steelhead, upriver game fish, and wildlife. The section on salmon and steelhead is subdivided into four specific areas of activity, dealing with downstream migration, hatchery and fish health research, habitat and passage improvements, and the Yakima Basin rehabilitation program.

Construction activities accounted for approximately one-fourth of the year's $25 million budget. The majority of the projects worked on during the year were started in 1983 and 1984, but 30 new ones were added. Several long-term research projects will continue into the 1990s as scientists monitor returning adult salmon and steelhead.

It is again gratifying to report that 1986 saw record returns of some stocks of salmon and steelhead and improvements over recent trends for most other species. The Corps of Engineers logged a 50-percent increase in spring chinook returning to the Columbia compared to the 10-year average. The summer steelhead run also surpassed the impressive 1985 record.

But it is too early to declare victory. Increased runs may be partly attributable to the cooperative efforts of Bonneville and other Federal and state agencies and Indian tribes. But natural forces have also played a part. It will take several more years before scientists are able to accurately evaluate the overall success of our efforts.

In FY 1987, Bonneville is budgeting $35.8 million to continue the task of rebuilding and protecting our valuable fish and wildlife resources.

James J. Jura

OPPOSITE:
Fish Creek, Oregon: site of several salmon habitat improvements.
DENNIS MAXWELL

Background

Some speculate that historic salmon and steelhead populations once ran as high 10 to 16 million fish. What seemed a limitless resource one hundred years ago has dwindled drastically as a direct result of human activities in and around the rivers and streams of the Columbia Basin.

Before the turn of the century, overharvest had already cut into salmon numbers. Dams built in the early 1900s to control floods and irrigate further aggravated the decline. Waterfront development, streamside cattle grazing, clearcutting, and chemical fertilizers all contributed to losses in salmon as the 20th century progressed. By the time the 30 dams of the Federal Columbia River Power System (FCRPS) were in place in the late 1970s, the situation had become critical for some salmon and steelhead runs — and too late for others. They disappeared completely.

Fish ladders were built at most of the Federal dams to provide passage for adult salmon returning to upstream spawning grounds. But engineers thought 343-foot Grand Coulee Dam on the upper Columbia was too high for fish ladders. By 1967, Hell's Canyon Dam had blocked salmon and steelhead from traditional spawning grounds on the Snake River. These two dams blocked migratory fish from more than 1,100 river miles of habitat. All along the river, vast reservoirs flooded additional miles of what had been salmon spawning and rearing grounds for thousands of years.

Power generating authorities did not even foresee the many other problems that would be caused by the operation of hydroelectric facilities — fish losses due to turbine blades, slow-moving currents in reservoirs, excessive predation, and gas bubble disease.

The Pacific Northwest Power Act

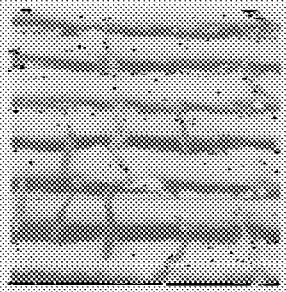
The Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Act) established the Northwest Power Planning Council (Council) and directed it to 'promptly develop and adopt a program to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries.'

The Council used recommendations from the region's Federal and state fish and wildlife agencies, Indian tribes, and other public and private groups, to create its Columbia River Basin Fish and Wildlife Program.

The landmark Act also defined a new role for Bonneville in charting the region's energy future. The agency was assigned the task of rebuilding and protecting fish and wildlife depleted by hydroelectric development and operation. Accordingly, Bonneville carries out a large part of the Council's Program.

Bonneville's long-term effort is aimed at reversing the steep decline in salmon and steelhead populations. Other projects are also underway to protect wildlife and non-migratory fish from the effects of hydro operation.

OPPOSITE: West Fork Hood Falls, Oregon: an impassable barrier replaced by a fish ladder. OREGON DEPARTMENT OF FISH AND WILDLIFE



Project Highlights, 1986

Bonneville in fiscal 1986 funded some $25 million worth of contracts to rebuild and protect the region's fish and wildlife resources. This was about 4 percent less than the previous year's budget. To date, Bonneville has spent a total of $83.4 million on more than 250 projects.

Of the 112 fish and wildlife contracts funded in 1986, 82 were ongoing and 30 were new projects. This compares with fiscal 1985's 142 contracts for 120 existing and 22 new projects. As these figures suggest, a good number of projects were completed during 1986, some of them after five or more years of work.

The bulk of the 1986 fish and wildlife budget — some 76 percent — worked to improve conditions for salmon and steelhead affected by the Columbia River hydro system through research studies, design and construction projects, and operations and maintenance services.

An important accomplishment was the funding and full operation of the Water Budget, a concept that is central to the regional strategy for protecting and enhancing stocks of migrating fish. Last year was actually the third year of formal Water Budget operation, a period in which managers made 37 requests for special water releases from upriver storage dams. Increased flows from these releases helped millions of young salmon on their downstream migration. In contrast to the previous year, 1986 flows and smolt migration times were close to normal.

About a fourth of the total funds Bonneville spent in 1986 went to build fish passage facilities and rehabilitate or improve habitat. Some 30 passage and habitat projects in Oregon and Idaho were finished during the year, plus another 5 in the Yakima Basin rehabilitation program.

On the West Fork Hood River, Oregon Department of Fish and Wildlife engineers completed a unique fish ladder that transformed an impassable waterfall into a gentle cascade. They terraced the entire stream channel with a series of 10 concrete weirs forming a giant stairway. Now returning adult fish have access to over 23 miles of prime upstream spawning habitat. Steelhead production should increase by 1,400 adults a year.

The U.S. Army Corps of Engineers, under contract with Bonneville, finished modifying the lower Umatilla River channel. Work crews blasted a trench in the riverbed to connect channels, remove outcrops, and concentrate enough water to allow fall chinook to move up the trench to the dam.

U.S. Forest Service engineers have completed habitat improvement projects at Lolo, Crooked Fork, and Eldorado Creeks in the Clearwater River Basin in Idaho. They have installed instream structures, removed rock barriers, and blasted rock to build jump pools.

A natural barrier that blocked access to habitat on Little Fall Creek, a tributary of the Willamette River in Oregon, became passable in 1986. Crews completed a fish ladder over a 24-foot falls and blasted pools to help migrating salmon and steelhead jump a second 8-foot falls on the creek.

In the Yakima Valley, efforts continued in a major program to rebuild the salmon fishery which has suffered from low water levels, poor water quality, and obstructed passage to potential spawning grounds. Projects at 20 sites were underway in 1986 to provide safe passage for fish past irrigation dams and canals. Crews finished ladders and fish screens at 5 sites - the main canals of Wapato Diversion Dam, the Satus Unit Diversion Dam on Toppenish Creek, Sunnyside Canal, the Richland Canal at Horn Rapids Dam, and the Old Reservation Canal on the Yakima Indian Reservation.

OPPOSITE: McNary Dam, Washington: young steelhead pass over a separator on their journey to the sea. WES TAFT

The completion of the Minthorn Springs and Bonifer Springs fish facilities on the Umatilla Reservation has helped reestablish fish runs which it is hoped will eventually reach 20,000 chinook and 10,000 steelhead annually. Biologists for the Umatilla Tribe use these facilities to acclimate and release juvenile fish and collect and hold returning adults for spawning. Bonneville funds the operation, maintenance, and monitoring of the facilities.

Under another contract, the Corps completed preliminary design of a hatchery facility capable of rearing 200,000 summer steelhead smolts for annual release into the Umatilla River via these on-reservation acclimation facilities.

Research studies investigating fish health and artificial propagation techniques continued to be an important part of the total effort to protect and enhance salmon and steelhead populations. Biologists studied the nutritional needs of young salmonids and the threat predators pose to their survival.

Other research projects aim to arrest a number of deadly viruses that kill large numbers of hatchery fish. Oregon State University biologists, for example, are trying to control infectious hematopoeitic necrosis (IHN), a deadly disease which attacks the blood system of young salmon, killing them almost instantly. In one year, IHN can destroy as many as 15 million young fish and can wipe out a hatchery's entire production.

The hydroelectric system has also affected game fish which live year-round in upriver streams, lakes, and reservoirs. A special case is the white sturgeon, a fish which once migrated up and down the Columbia and its tributaries but is now confined between dams. Bonneville funded 3 projects to investigate hydro impacts on this mysterious ancient species.

At the recently completed Cabinet Gorge kokanee salmon hatchery on Lake Pend Oreille, Idaho, officials released the first fry into the Clark Fork River in July. Biologists predict the hatchery will add as many as 1 million kokanee to the lake's fishery within 3 to 5 years. Cabinet Gorge will have the capability of producing one-third of all Idaho's hatchery fish.

Wildlife projects received 4 percent of the 1986 funds. One unusual new project is the study of a colony of bald eagles which has established a wintering area near Lake Pend Oreille in Idaho. The big attraction for this endangered species is the new kokanee hatchery. Some 60 eagles feed on fish that die after spawning in Lake Pend Oreille and the Lower Clark Fork River. The colony could soon grow to several hundred.

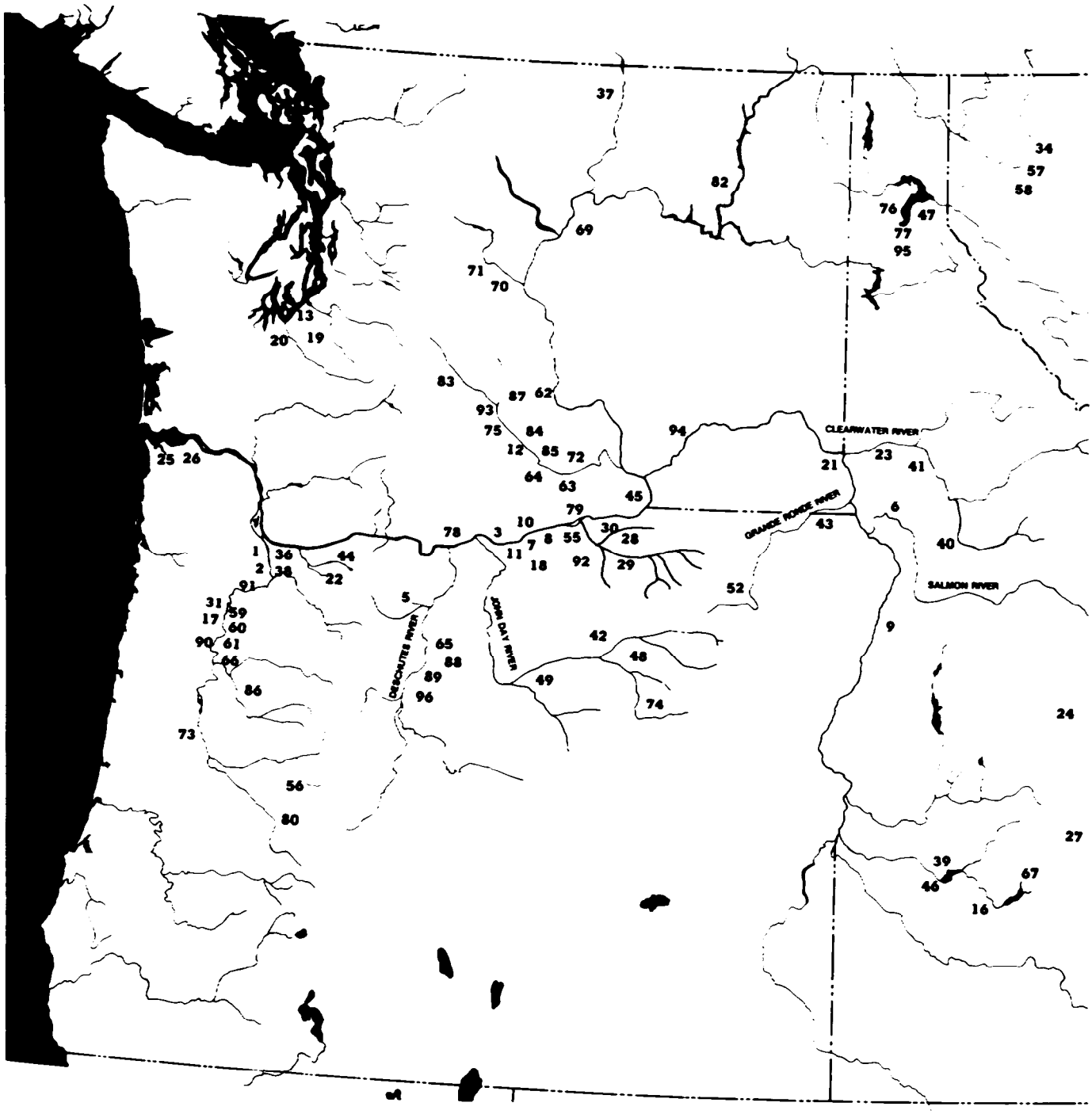
Efforts continued to save a small band of western Montana bighorn sheep from extinction. The native Ural-Tweed herd lost 12,000 acres of prime habitat to Libby Dam's reservoir and shrank from 200 sheep to 25. But the bighorns are making a comeback and have doubled their population, helped by 2 Bonneville-funded projects. Project workers are improving the grazing lands above the reservoir by clearing trees, reseeding grass on the slopes, and fertilizing shrubby areas.

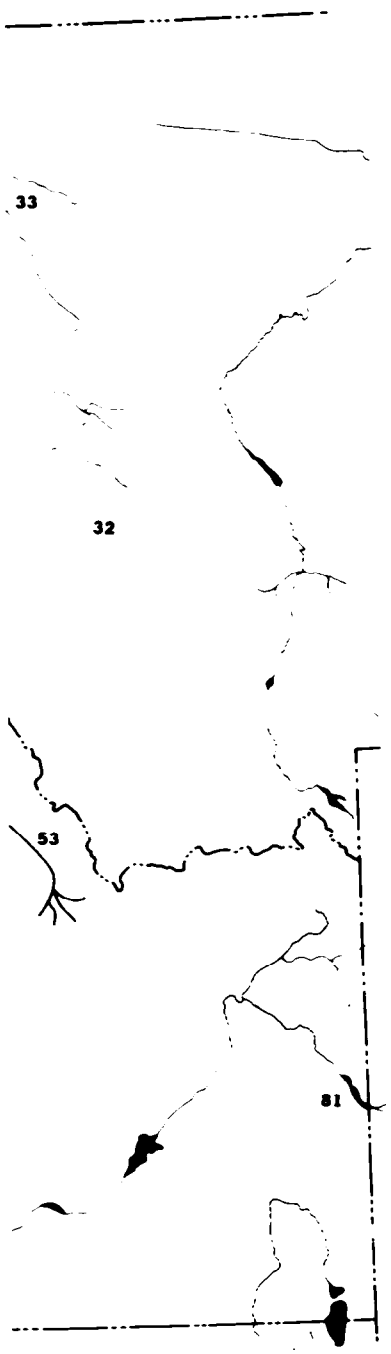
For further information or literature on specific projects, contact:

Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621
Portland, Oregon 97208

OPPOSITE:
Malheur County, Oregon: burrowing owl surveys the winter landscape.
BRYAN PETERSON

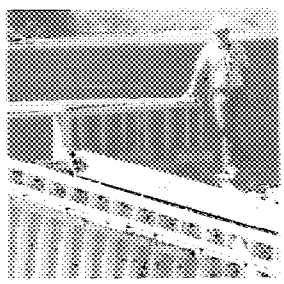
FISH AND WILDLIFE PROJECTS





Map Numbers Project Title

1 An Evaluation of the Contribution of Chinook Salmon Reared at Columbia River Hatcheries to the Pacific Salmon Fisheries
2 Smolt Monitoring Program
3 Flow and Spill Requirements for Juvenile Fall and Summer Chinook Salmon in John Day Reservoir
4 Effects of Operation of Kerr and Hungry Horse Dam on Reproductive Success of Kokanee in the Flathead System
5 Establishment of Baseline Information for the Warm Springs Indian Reservation
6 A Biological and Physical Inventory of the Streams Within the Nez Perce Reservation
7 Use of a Fish Transportation Barge for Increasing Returns of Steelhead Trout Imprinted for Homing in the Yakima River
8 Feeding Activity, Rate of Consumption, Daily Ration, and Prey Selection of Major Predators in the John Day Reservoir Pool
9 Snake River Fall Chinook Brood Program
10 Estimate Abundance and Growth Characteristics of Squawfish and Walleye in John Day Reservoir and Tailrace
11 Coded Wire Tag Sampling
12 Natural Production Assessment and Rehabilitation of Spring Chinook
13 Control & Development of Hatchery Practices & Antiviral Drugs to IHN Virus in Sockeye, Chinook Salmon, and Steelhead Trout
14 Lower Flathead River Fisheries Study
15 Impact of Water Levels on Canada Geese
16 Idaho Habitat Evaluation (Offsite Mitigation Record)
17 Epidemiology and Control of Infectious Disease of Salmonids in the Columbia River Basin
18 Pen Rearing and Imprinting of Fall Chinook Salmon
19 Columbia River White Sturgeon Enhancement
20 Biological Feasibility of a New Fish Tagging System
21 Smolt Condition and Timing of Arrival at Lower Granite Reservoir
22 Hood River Passage, Oregon
23 Nez Perce Reservation Propagation Facilities
24 Rehabilitate and Protect Critical Anadromous Salmonids Spawning and Rearing Habitat in Bear Valley Creek
25 Development for Rations for the Enhanced Survival of Salmon
26 Evaluation of Low-Cost Salmon Production Facilities
27 Alturas Lake Creek Flow Augmentation
28 Lower Umatilla River Channel Modifications to Allow Restoration of Upriver Bright Fall Chinook and Enhance Summer Steelhead Production in the Umatilla River Basin
29 Umatilla Release, Collection, and Holding Facilities
30 Modification of Three Mile Dam to Improve Adult Salmon and Steelhead Passage in the Lower Reaches of the Umatilla River
31 Stock Identification of Columbia River Chinook and Steelhead
32 Evaluation of Water Releases at Painted Rocks Reservoir
33 Quantification of Hungry Horse Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries
34 Quantification of Libby Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries
35 Enloe Dam Passage
36 Water Budget Management
37 Impacts of Water Level Fluctuations on Canada Geese
38 Water Budget Management
39 Protection of Wild Steelhead In the Upper Snake River, Idaho
40 Red River Crooked River Fish Passage Habitat Improvements
41 Clearwater River Habitat Enhancement (Lolo, Crooked Fork, & El Dorado Creeks)
42 John Day River Habitat Enhancement (Clear, Granite, North Fork)
43 Grande Ronde Habitat Enhancement (Joseph, Peavine, Elk, and Chesnimnus Creeks)
44 Habitat Enhancement: Collawash Falls, Fish & Lake Branch Creeks
45 Smolt Monitoring at Federal Hydroelectric Facilities
46 Freeze Branding of Salmon and Steelhead for Water Budget Studies—Idaho
47 Cabinet Gorge Kokanee Hatchery - Lake Pend Oreille, Idaho
48 John Day River Habitat Enhancement (Main Stem, Middle Fork)
49 John Day River Habitat Enhancement (East Fork Beech Creek, Canyon, Big Boulder Granite Boulder Creeks)
50 Camas Creek Habitat Enhancement
51 Marsh, Elk Creeks and Upper Salmon and Middle Fork Salmon River, Idaho Habitat Enhancement
52 Grande Ronde River Habitat Enhancement
53 Lemhi River Habitat Rehabilitation
54 Panther Creek Habitat Rehabilitation
55 Umatilla River Summer Steelhead Hatchery
56 Wildlife and Wildlife Habitat Loss Assessment for the Willamette River Projects
57 Ural-Tweed Bighorn Sheep - Wildlife Mitigation Project
58 Ural-Tweed Bighorn Sheep - Wildlife Mitigation Project
59 Development of a Subunit Vaccine Against Infectious Hematopoietic Necrosis (IHN) Virus
60 Influence of Nutrition on the Immune Response in Hatchery Reared Salmonids (Ceratomyxosis, Kidney Disease and Furunculosis)
61 Evaluate Vaccines for Bacterial Kidney Disease (BKD) in Salmon
62 Juvenile Salmonid Monitoring at Rock Island Dam Bypass Sampler
63 Wapato Screen & Ladder Construction
64 Toppenish Creek Satus Unit Screens & Ladder Construction
65 Trout Creek Riparian Restoration
66 Effects of Vitamin Nutrition on the Immune Response System of Hatchery-Reared Salmonids
67 Wildlife and Wildlife Habitat Loss Assessments for the Anderson Ranch, Black Canyon, and Boise Diversion Hydroelectric Facilities in Idaho
68 Juvenile Radio Tag Studies
69 Preliminary Design of Colville Hatchery
70 Tumwater Falls Dam Passage
71 Dryden Dam Passage
72 Evaluation of the Effectiveness of the Sunnyside Fish Screens and Richland Canal
73 Willamette Spring Chinook Study Plan
74 South Fork John Day River Passage Improvement Mainstem & Izee Falls
75 Temporary Fish Passage on Toppenish Creek
76 Kokanee Stock Status in Lake Pend Oreille and Evaluation of Cabinet Gorge Hatchery
77 Cabinet Gorge Eagle Study
78 Evaluate Sturgeon Physical Habitat Requirements
79 Downstream Migrant Monitoring
80 Willamette River Projects Wildlife Mitigation Plans
81 Upper Snake River Projects Wildlife Mitigation Plan
82 Grand Coulee Wildlife Mitigation Plan
83 Little Naches River Passage
84 Satus Creek Screen Ladder Construction
85 Upper Toppenish Ladder Construction
86 Little Fall Creek Fish Passage
87 Predesign for Yakima Basin Fish Passage
88 Trout Creek Benefit Cost
89 Trout Creek Benefit Cost Analysis Photomosaics Refinement
90 Facilty Support for BKD Vaccine Test for Salmon
91 Evaluation and Monitoring Workshop
92 Umatilla River Basin Salmon and Steelhead Plan Evaluation
93 Toppenish Westside Ellensburg Screen Fabrication
94 Freeze Branding Salmon and Steelhead
95 Engineering Evaluation of Cabinet Gorge Hatchery
96 Trout Creek Enhancement - Implementation



Programwide Activities

With over 100 fish and wildlife projects underway at any given time, Bonneville managers must apply consistent standards and accounting policies in line with clear overall objectives. To this end, the agency funded two projects in 1986 which help clarify the 'big picture.'

Such programwide studies evaluate and quantify the overall effects of hydroelectric development on fish and wildlife and establish criteria for projects undertaken to offset negative impacts. The studies enable managers to integrate important fish and wildlife concerns into agency plans and programs.

The information also helps Bonneville develop policies that fulfill its responsibilities under the Pacific Northwest Power Act to afford fish and wildlife 'equitable treatment' with power generation in the management and operation of the region's Federal dams.

Development of Criteria and Methods for Assessing Potential Cumulative Effects of Hydroelectric Development on Fish and Wildlife (84-41)

A single hydroelectric development can cause measurable losses to fish and wildlife in and around it, but when several developments are concentrated in one river basin the cumulative impact may be far greater than what would be expected from any individual dam.

Past planning did not sufficiently consider the impact of individual projects in relation to the effects of other existing and proposed projects. Consequently, hydroelectric development in some basins has resulted in unusually large losses to fish and wildlife.

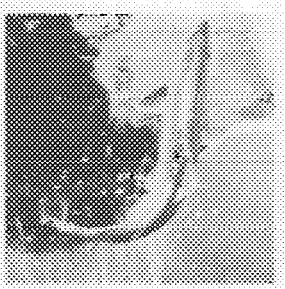
In this study, researchers continued developing a methodology to assess these cumulative effects. They have examined the literature and analyzed existing techniques for assessing the effects of hydroelectric development. The methods are expected to be used by hydroelectric operators, planners, and others to help in reviewing proposed hydro development in the region. The final task report is due in 1987.

Design of Studies for Development of Bonneville Fish and Wildlife Mitigation Accounting Policy (85-87)

This project designs studies to be used in developing methods to estimate salmon and steelhead losses from hydro development and operation in the region. These methods will also be used to measure progress attributable to Bonneville-sponsored mitigation efforts. The research will provide information needed to develop the Fish and Wildlife Mitigation Accounting Policy. Bonneville's responsibility to protect, mitigate, and enhance fish would be determined from an empirical and analytical basis and would be fulfilled with maximum net benefit to the region.

Researchers are attempting to design an analytical system of the ecologic, hydrologic, and economic aspects of anadromous fish production in the Columbia Basin. The challenge is to find ways to simulate the impact of the existing hydroelectric system on fish productivity and to provide an analytical foundation for projecting the fish productivity response to hydrosystem mitigation actions and environmental changes in the biologic and hydrologic system. The eventual analytical system should, after biologic and hydrologic data are integrated, provide an estimate of total losses and of the proportion of fish losses attributable to FCRPS functions.

OPPOSITE: Tumwater Falls, Wenatchee River, Washington: Roger Purdom, Chelan County PUD, inspects forms before concrete is poured on a joint BPA-PUD fish ladder project. WES TAFT



Salmon and Steelhead

In the Portland offices of the Water Budget Managers, staff are on the phone all morning talking to biologists, hatchery managers, and dam operators. It is late April, and another half million young hatchery salmon are being released to start their downstream migration.

But dam operators are holding back the melting spring waters, storing the water to produce power and irrigate crops later in the year. Slow currents in the dam reservoirs are delaying the fish. Another phone call to the U.S. Army Corps of Engineers finalizes the arrangements. Soon several million gallons will flow down the Mid-Columbia and through Priests Rapids Dam.

The water is not for power production — it is released specifically to speed the young migrants' long journey to the ocean.

By the end of 1986 the Water Budget had been in operation 3 full years. This unique procedure is a central part of the regional strategy to make up for ongoing fish losses at hydroelectric dams.

Bonneville spends the bulk of its fish and wildlife budget on migratory — or *anadromous* — fish. Projects work to promote the survival of the salmon and steelhead species whose environment has been transformed by hydroelectric development over the past half century.

Getting fish past the dams on the Columbia and Snake Rivers is only one part of the overall program to 'protect, mitigate, and enhance' this valuable natural resource at all life stages.

In the Oregon State University laboratories at Corvallis, biologists study slivers of tissue and water samples under microscopes as they piece together the life history of a killer parasite.

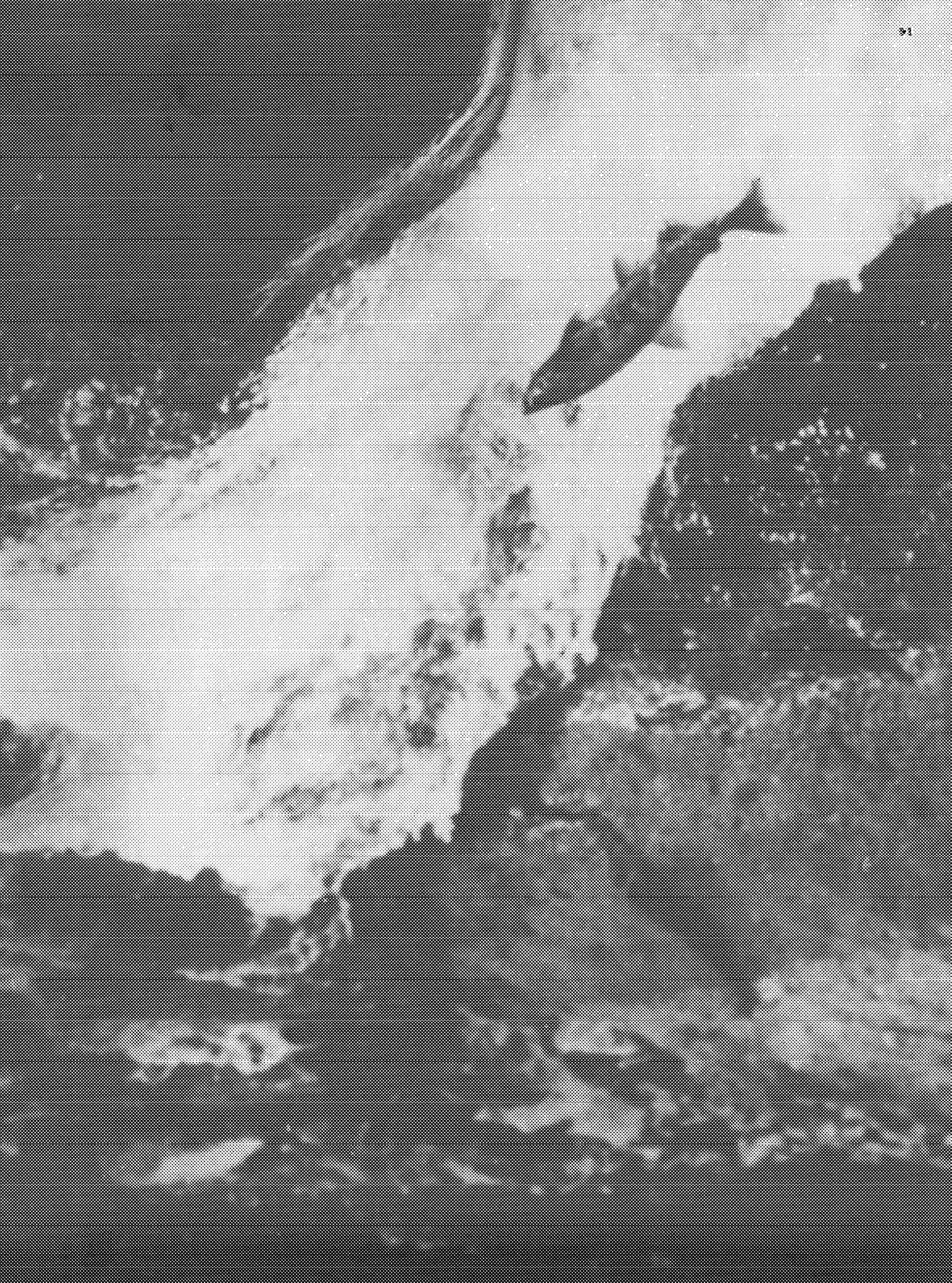
This disease is called ceratomyxosis. It occurs naturally in the Columbia River and kills far more fish than was realized. The disease is spreading and, so far, cannot be controlled. Suspecting the pathogen uses an intermediate host to reach and infect the fish, researchers are using a fluorescent antibody to check freshwater mussels for signs of infection.

More than 20 Bonneville-funded projects are researching fish health, especially at hatcheries, where up to 80 percent of today's Columbia salmon start life. Biologists are searching for ways to provide better nutrition, prevent disease and stress, and improve smolt health, so more hatchery fish will survive the stresses of migration.

They are also concerned about integrating hatchery releases and wild runs. When a particular stock of fish is ready to migrate, the hatchery will release all of them — several thousand — in a matter of a few hours. This sudden influx of hungry mouths can destroy the natural balance existing in the river. The hatchery fish compete with wild fish for food and can overwhelm the wild population through sheer numbers. Hatchery managers are working to time hatchery releases to lessen the impact on native runs.

Wild salmon are important to the environmental health and financial well-being of many locations in the Pacific Northwest. But wild fish cannot survive without suitable habitat.

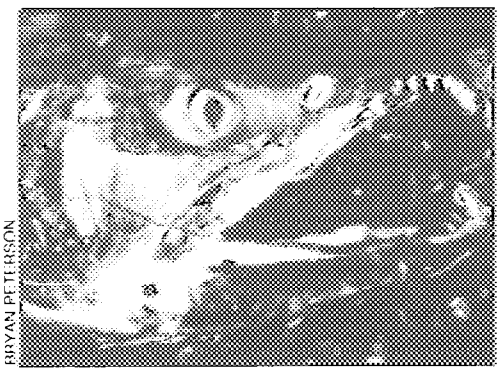
OPPOSITE: Western Washington State: Coho salmon leaps a ladder. JACK ORSBORN



On Meadow Creek, a tributary of the South Fork Clearwater River in Idaho, U.S. Forest Service engineers from the Nez Perce National Forest shatter the calm by detonating a charge of dynamite. The explosion loosens the face of a waterfall which they are reshaping so migrating fish can leap over it. More blasts deepen jump pools and break up a cluster of large boulders that had created an almost impassable cascade.

Upstream from these natural obstacles lie miles of underused spawning and rearing habitat, perfect for increased production of wild chinook and steelhead if made accessible.

Areas where wild migrating fish can spawn and rear have declined drastically in the 20th century. First, soil erosion, overgrazing, logging and irrigation took their toll. More recently, hydroelectric development has destroyed or cut off hundreds of miles of natural habitat in the Columbia and Snake Rivers. Combined, man's activities have eliminated as much as 75 percent of the region's fish habitat, contributing to an 80 percent decline in wild runs.



BRYAN PETERSON

Spawned-out male chinook in the Yakima River.

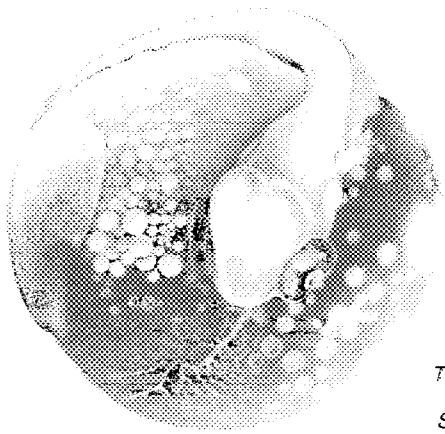
Stretches of many tributary streams still offer great potential, but are unreachable because of natural obstructions, like at Meadow Creek, or manmade obstacles such as dams. Other sites need improvements to bring existing natural habitat up to full productive potential. Here, crews build rock weirs, dredge pools, place log structures in the stream, and plant streamside vegetation.

A special situation exists in the Yakima Basin, where Bonneville and many other agencies are cooperating in a program to improve fish passage and enhance habitat. Irrigation has transformed this once barren prairie into one of the most productive agricultural regions in the world but has taken its toll on anadromous fish.

Runs have suffered from low flows, poor water quality, and inadequate passage facilities at the irrigation diversion dams. Engineers are building new fishways and screens at the dams and modifying channels to open access to upstream areas, where good spawning and rearing habitat exists. Fishery experts believe the Yakima Basin could support greatly increased salmon and steelhead populations.

Though virtually all the damage to Yakima fish runs is due to irrigation and not hydropower, this series of projects is considered compensation for fish losses occuring at hydro facilities on the mainstem Columbia.

Of the dollars Bonneville spends on salmon and steelhead, nearly half goes toward reestablishing wild fish populations and rebuilding their spawning and rearing habitat. In 1986, a total of 37 habitat and passage improvement projects were underway.



The beginning and end of a cycle: Salmon embryo in its 24th day of growth. MIKE CARPENTER

OPPOSITE: Dugan Falls, Little White Salmon River, Washington: Salmon attempts to leap a falls. SHARON BLAIR

Downstream Migration: Project Descriptions

Water Budget Managers (83-491/536)

Smolt Monitoring Programs (80-1/86-60, 84-14, 84-17, 86-119, 84-54)

Flow and Spill Requirements for Juvenile Fall and Summer Chinook Salmon in John Day Reservoir (81-1)

Use of a Fish Transportation Barge for Increasing Returns of Steelhead Trout Imprinted for Homing (82-2)

Feeding Activity, Rate of Consumption, Daily Ration, and Prey Selection of Major Predators in the John Day Reservoir (82-3)

Abundance and Growth Characteristics of Squawfish and Walleye in John Day Reservoir and Tailrace (82-12)

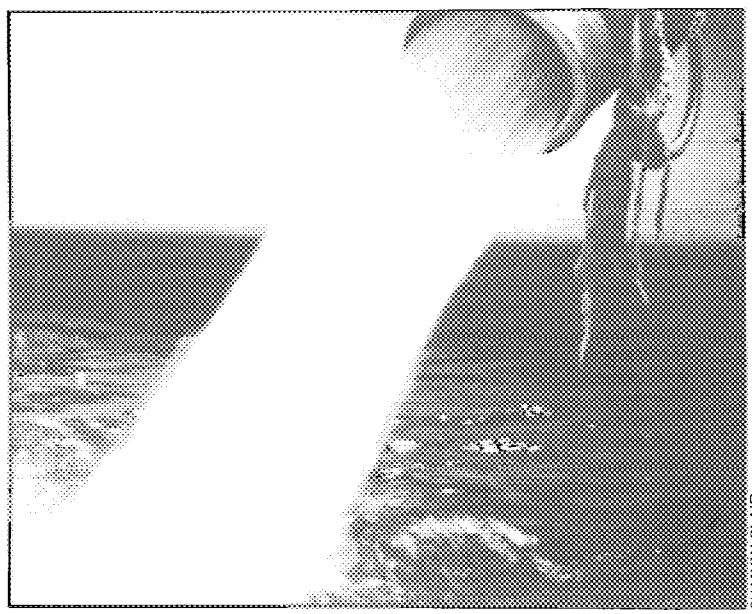
Coded Wire Tag Recovery Program (82-13)

New Fish Tag System (83-319)

Smolt Condition and Timing of Arrival at Lower Granite Reservoir (83-323)

Juvenile Radio Tag Studies (85-35)

Evaluate Alternate Bypass Conduit Designs (86-47)



SHARON BLAIR

McNary Dam, Washington: loading salmon and smolts into a fish barge for a ride down the Columbia.

OPPOSITE: McNary Dam, Washington: fall chinook smolt in a barge holding tank.
SHARON BLAIR

Water Budget Managers (83-491/536)

Between April 15 and June 15 of each year, when millions of young steelhead and salmon are migrating from tributaries and streams and down the Columbia River, flows can sometimes be insufficient to carry them to the ocean quickly enough.

To alleviate this problem, the Council, in its 1983 Fish and Wildlife Program, initiated the Water Budget, a predetermined volume of water that can be released each year from upriver storage dams to help flush smolts downstream. Releases are timed to parallel the spring runoff that would carry juveniles to the sea under natural conditions. The goal is to get smolts through slackwater reservoirs more quickly, reducing their exposure to predation, disease, and stress.

Two Water Budget managers coordinate the budgeted flows in cooperation with power system operators. They represent the state and Federal fish and wildlife agencies and the Columbia Basin Indian Tribes.

During 1986, program managers made 37 operational requests for Water Budget and flow/spill augmentation. Preliminary data indicate flows were normal, the timing of outmigration was normal, and the number of migrating juveniles was above average.

The success of the Water Budget in increasing smolt survival depends on several other Bonneville-funded projects that monitor the progress and condition of the smolts. After data on flows, smolt travel time, survival rates, and returning adults has been collected and analyzed, the managers use it to evaluate how well flow and spill manipulation and structural bypasses help fish survival.

Smolt Monitoring Programs (80-1/86-60, 84-14, 84-17/86-119, 84-54)

Keeping track of the daily movements of salmon and steelhead throughout the Columbia River system ensures Water Budget managers can most effectively help young migrants downstream. Timely and accurate information is essential.

Various agencies and organizations sample tagged and branded fish at dams. These smolt monitoring programs supply the data needed to evaluate the success of the Water Budget and recommend improvements.

Water Budget managers coordinate the overall program. The National Marine Fisheries Service (80-1/86-60) and other agencies gather information on numbers of fish marked, juvenile releases, timing of migration, streamflows, water conditions, smolt transportation, and counts of returning adults.

The central computer network for storing and analyzing the data — the Fish Passage Data Information System — is located in Portland. Operators at monitoring sites enter their daily data at remote terminals, so Water Budget managers have instant access to the latest fish migration information. Members of the public also have access to the data.

The NMFS monitored and indexed smolt migration at five Columbia River dams during 1986 — Lower Granite, McNary, John Day, Lower Monumental, and Bonneville (84-14). Chelan County Public Utility District in Washington also took daily fish samples from the orifice trap at Rock Island Dam (84-54). Field workers kept daily records of catch numbers, species composition, and their brands and marks.

Idaho Department of Fish and Game (84-17) began freeze-branding a half million chinook salmon and steelhead smolts from ten hatcheries in preparation for the 1987 outmigration. Meanwhile, Washington Department of Fisheries (86-119) completed freeze-branding 216,000 smolts at Lyons Ferry Hatchery for use in monitoring the 1986 migration. Researchers use liquid nitrogen to brand a sequence of numbers on to the side of the fish.

Flow and Spill Requirements for Juvenile Fall and Summer Chinook Salmon in John Day Reservoir (81-1)

Juvenile fish migrating in the spring clearly benefit from the increased water velocities of the seasonal high flows. So fishery agencies often request increased flows during the summer to help summer migrants downstream when flows are naturally lower. However, even during years of high flow, many young summer and fall chinook remain in the reservoirs for extended periods. This suggests factors other than flow determine migration patterns of fall and summer chinook.

The aim of this research project is to determine how reservoir flows and spills affect the passage time, behavior, and survival of summer and fall chinook smolts as they pass through John Day Reservoir. Data collected helps researchers relate instream flow and spill at the dam to the amount of time smolts spend in the reservoir. It will also help determine how their passage time influences their survival rate.

Researchers from the National Marine Fisheries Service (NMFS) initiated this project in 1981 and finished the first phase dealing with migrating juveniles in 1984. A draft final report of the juvenile phase, completed in 1986, suggests summer migration is not expedited by attempting to flush fish through the reservoir with flows up to 380 kcfs (thousands of cubic feet per second). It is uncertain whether this condition exists in other reservoirs on the Columbia System.

Work continued in 1986 on the project's second phase - the monitoring of returning adults tagged during the 1981 through 1983 seasons to determine smolt survival rates. Researchers will analyze adult return data and prepare a final project report in 1987.

Use of a Fish Transportation Barge for Increasing Returns of Steelhead Trout Imprinted for Homing (82-2)

Physically transporting smolts downstream around the hazards of dams and reservoirs greatly increases their chances of survival. But young salmon and steelhead starting the outmigration by barge or truck may lose some or all of the homing instinct that guides them back to their stream or hatchery of origin as adults.

This 6-year study, begun in 1982, is one of several conducted by the NMFS to gather information about methods and techniques of increasing the return of transported fish to desired locations.

At the Dworshak National Fish Hatchery (NFH), researchers tagged juvenile steelhead and imprinted them, providing biological clues to act as homing mechanisms. The fish were transported by truck to nearby Lewiston, Idaho, then transferred to a barge which carried them downstream for release below Bonneville Dam.

The project will determine whether these fish return in greater numbers to Dworshak Hatchery and the Idaho fishery than hatchery fish released directly into the stream. Investigators will learn how many fish in each release group have accepted a homing imprint, and this data will help them understand how a fish's physiological condition influences its ability to accept an imprint.

Work continued during 1986 on sampling returning adult steelhead at the collection facilities at Bonneville, McNary, and Lower Granite Dams, the Indian fishery on the Clearwater River, the sport fishery on the Snake and Clearwater Rivers, and at the Dworshak NFH homing site. Analysis of returns will continue through 1987, and the final results should provide resource managers with useful information for increasing steelhead runs.

Feeding Activity, Rate of Consumption, Daily Ration, and Prey Selection of Major Predators in the John Day Reservoir (82-3); Abundance and Growth Characteristics of Squawfish, Walleye, and Smallmouth Bass in John Day Reservoir and Tailrace (82-12)

Columbia River reservoirs created by hydroelectric projects have provided ideal habitat for increased numbers of predator fish. This has inevitably influenced the survival rates of juvenile salmon and steelhead. Two studies are investigating to what extent resident populations of native and introduced fish in the John Day reservoir and tailrace prey on young salmonids.

The U.S. Fish and Wildlife Service is studying four major predators in John Day Reservoir (82-3) — northern squawfish, walleye, smallmouth bass, and channel catfish — and evaluating how each contributes to the overall problem.

In 1986, researchers continued to collect predator and prey species at various sampling stations. This year they also focused on collecting squawfish and catfish below McNary Dam to determine if these predators select injured or diseased salmonids in the dam tailrace.

Analysis of predators' stomach contents indicated the condition and selection of prey. Biologists then conducted laboratory experiments to estimate consumption and digestion rates. The team also continued to refine the computer programs that integrate and analyze this data.

Oregon Department of Fish and Wildlife, working closely with USFWS biologists, develops estimates of population, age, and mortality of the major predators in John Day Reservoir (82-12). ODFW continued to develop a model of the effects of predation on the salmonid population and study what might be done to regulate it.

By 1988, data from these related studies will be combined to develop mechanical and/or biological techniques to control predation, which if successful could greatly increase the survival of salmon and steelhead migrating downstream.

Coded Wire Tag Recovery Program (82-13)

Many of Bonneville's research activities depend on data from coded wire tags implanted in fish snouts to evaluate the various species' survival rates, timing of migrations, and contribution to fisheries. Other Federal and state fish and wildlife agencies and regional Indian tribes, both in the U.S. and Canada, also tag fish and analyze recoveries.

But first, the tags — microscopic strands of wire coded to identify the fish — must be recovered from ocean and freshwater sport and commercial catches. Biologists remove the wire and read its codes under a microscope to learn the releasing agency, hatchery, and release group.

The Pacific Marine Fisheries Commission coordinates the overall recovery effort, ensuring all fisheries are sampled and duplicate sampling is avoided. The goal is to sample 20 percent of the salmon landed in Oregon recreational and commercial fisheries every year. In 1986 this amounted to more than 22,000 tags.

Through this project Bonneville contributes an annual 'fair share' to PMFC's recovery effort.

New Fish Tag System (83-319)

National Marine Fisheries Service researchers last year continued their experiments with a new computerized fish tagging technique that will more accurately track the movements of migrating fish. They are developing miniature computer chips called passive integrated transponders, or PIT tags, for harmless implantation in the body cavity of smolts.

Each PIT tag, about the size of a grain of rice, stores one of 34 billion unique codes individually identifying each host fish. It incorporates a tiny antenna, enabling scientists to read its coded information with a scanner.

Detecting recording devices mounted in dam fishways and turbine bypass systems will be able to monitor every tagged fish passing through. Tag detectors will precisely log the arrival and departure times of individual fish — without anyone handling them — and automatically log the data on computer files. Unlike conventional tagging techniques, the PIT tag does not delay or harm the fish.

Tests conducted to date have been very encouraging, but several biological and technical problems remain to be resolved. Work in 1986 included laboratory tests to determine the minimum sized fish with a 95 percent chance of retaining the tag for 45 days. Researchers also studied the tag's possible effects on fish growth, survival, and swimming efficiency. Field work focused on testing two prototype PIT tag monitoring systems at McNary Dam and installing a third at Lower Granite Dam. Other studies aimed at developing an overall system for using the technique, including a PIT tag injection device.

This new tagging system could vastly improve the efficiency and accuracy of estimating the growth, survival, migration speed, and distribution of migrating fish.

Smolt Condition and Timing of Arrival at Lower Granite Reservoir (83-323)

Chinook and steelhead smolts reared in Idaho hatcheries and the natural environment pass through numerous dams to reach the ocean each spring. They are subject to many hazards and can be delayed by low river flows, especially in the reservoirs. Many smolts arriving at the Lower Granite bypass facility show substantial scale loss and other signs of deteriorating health.

In this study, scheduled to run through 1990, biologists from the Idaho Department of Fish and Game catch smolts in special traps installed in the Lower Snake and Clearwater Rivers and evaluate their condition. The traps were designed and built, using Bonneville funds, by the National Marine Fisheries Service. Project personnel also time the arrival of large groups of migrants at Lower Granite Reservoir — important information for Water Budget managers, who can then schedule water releases to move the smolts rapidly downstream.

The biologists also study downstream migration timing under different river discharge conditions and monitor the smolts' physical condition during the trip. They are trying to determine how much descaling occurs before the fish reach the Lower Granite area.

Juvenile Radio Tag Studies (85-35)

The idea of implanting young salmon with radio tags before releasing them above dams offers researchers a powerful tool for assessing fish behavior and passage problems. Antennas could detect and record individual fish passing through the dam, providing an accurate method of measuring collection efficiency, guidance system efficiency, spillway survival, powerhouse survival, and collection system survival.

The National Marine Fisheries Service is conducting a research project at Lower Granite Dam to test the concept. Researchers have set up a system of strategically located detector antennas to monitor radio-tagged juvenile salmon.

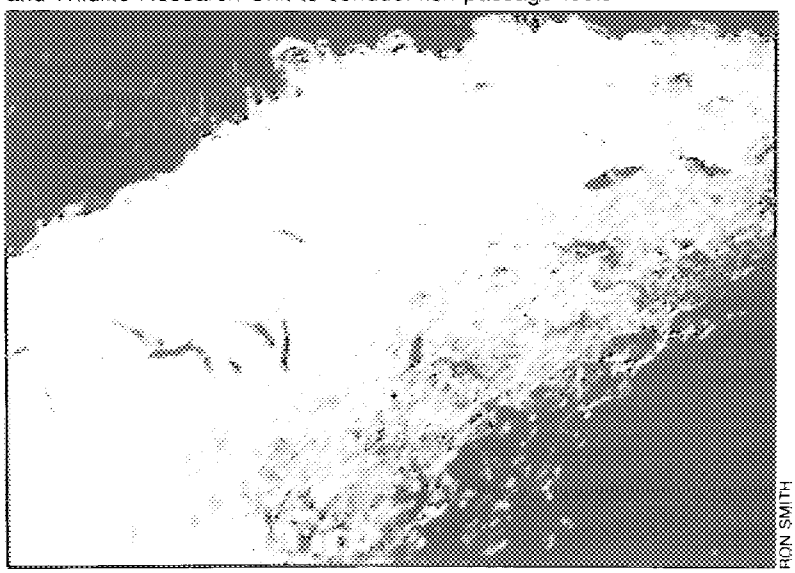
Work continued in 1986 on development and testing of a more efficient microprocessor-based monitor for faster scanning of frequencies and more sensitive antennas for detecting tags in deep-water areas.

Evaluate Alternate Bypass Conduit Designs (86-47)

As juvenile salmon and steelhead migrate downstream past dams, they may be injured by screening and bypass systems. The pressurized conduit bypass systems used at most dams are partly responsible for this. An open flume could potentially minimize injuries to fish. In this project, the Corps of Engineers began work on modifying the flume test facilities at Lower Granite Dam on the Snake River.

Renovation work on the existing corrugated metal flume will include redesigning the dewatering system and sample tanks, painting the structure, and covering it with translucent material. The Corps will then evaluate downstream passage.

Another part of the project is to select a design for replacement of an existing 2-foot wide baffled flume with a new 4-foot baffled flume. The Corps will also supervise construction, which is scheduled for completion by the summer of 1987, and contract with the Idaho Cooperative Fish and Wildlife Research Unit to conduct fish passage tests.



RON SMITH

Bonneville Hatchery, Oregon: releasing coho smolts into the Columbia River.

Hatchery and Fish Health Research: Project Descriptions

Evaluation of the Contribution of Fall Chinook Salmon Reared at Columbia River Hatcheries to the Pacific Salmon Fisheries (79-2)

Development of Hatchery Practices and Antiviral Drugs to Control IHN Virus in Sockeye and Chinook Salmon and Steelhead Trout (82-21)

Epidemiology and Control of Infectious Diseases of Salmonids in the Columbia River Basin (83-312)

Pen Rearing and Imprinting of Fall Chinook Salmon (83-313)

Low Technology Fisheries Facilities for the Enhancement of Anadromous Salmonid Stocks on the Nez Perce Reservation (83-350)

Development of Diets for Enhanced Survival of Salmon (83-363)

Evaluation of Low Cost Salmon Production Facilities (83-364)

Minthorn Springs Creek and Bonifer Springs Creek Summer Steelhead Juvenile Release and Adult Collection Facility (83-435)

Stock Identification of Columbia River Chinook Salmon and Steelhead Trout (83-451)

Protection of Wild Adult Steelhead in Idaho by Adipose Fin Removal (84-2)

Umatilla River Summer Steelhead Hatchery (84-33)

Development of a Subunit Vaccine Against IHN (84-43)

Influence of Vitamin Nutrition on the Immunity Response of Hatchery-reared Salmonids (84-45, 84-945)

Evaluate Vaccines for Bacterial Kidney Disease in Salmon (84-46); Facility Support for BKD Vaccine Testing in Salmon (86-96)

Willamette Spring Chinook Study Plan (85-68)

Anadromous Fish Health Monitoring in Washington (86-13, 86-54)

John Day Acclimation Pond (86-82)

Evaluation of the Contribution of Fall Chinook Salmon Reared at Columbia River Hatcheries to the Pacific Salmon Fisheries (79-2)

An important part of the regional program to make up for fish lost through hydroelectric development is the construction and operation of hatcheries. Some salmon hatcheries consistently make a significant contribution to ocean and in-river fisheries, with enough adult fish returning each year to maintain stocks. Other facilities, however, release equal numbers of young fish but, for unknown reasons, see far fewer returning adults.

In this 8-year project, NMFS biologists first implanted almost 14 million coded wire tags in 3 successive brood years of hatchery-raised fall chinook. Then they sampled Pacific coast marine fisheries from California to Alaska and Columbia River fisheries, hatcheries, and adjacent streams for tagged fish from the project. In 1986, researchers collected wire tags from fall chinook and compiled the data. They should complete final tabulation of all tag returns by fall of 1987.

Using this data, researchers will determine how each hatchery release contributes to salmon fisheries. The study covers the importance of such variables as disease history, smolt size at release, diet, and time of release. Hatchery managers can use the information to alter production techniques and become more efficient in mitigating fish losses from hydroelectric development.

Development of Hatchery Practices and Antiviral Drugs to Control IHN Virus in Sockeye and Chinook Salmon and Steelhead Trout (82-21)

Infectious hematopoietic necrosis (IHN) viral infections have killed many million hatchery fish in the Columbia River system in recent years. The virus is believed to be transmitted mainly through water. All salmon species and cutthroat, rainbow, and steelhead trout are susceptible to the disease.

In this project, broodstock culling (segregation) is being tested as a way to control the IHN disease. By this method, fish carrying high levels of the virus are separated from the broodstock and their eggs destroyed. Biologists also investigated various routes of infection and locations where the virus may reside when not in the infectious state.

After 3 years of culling, the incidence of IHN is substantially lower at one test hatchery, but the cause and effect relationship is still uncertain. While broodstock culling has merit, it carries a risk of unwanted genetic selection and even the possible destruction of genetic strains of salmon and steelhead.

Drugs are being tested for their ability to block transmission of the IHN virus. Five of 26 drugs tested showed promise.

Epidemiology and Control of Infectious Diseases of Salmonids in the Columbia River Basin (83-312)

Since 1983, Oregon State University researchers have investigated the geographical range and pattern of occurrence of several viral, protozoan, and bacterial fish pathogens. They are studying methods of estimating disease-induced mortality and morbidity in hatcheries, rivers, and the Columbia River plume of the Pacific Ocean, emphasizing prevention and control rather than seeking cures to the diseases.

Biologists have determined that one important pathogen, a parasite called ceratomyxosis which occurs naturally in the Columbia River, causes far more mortality than was previously suspected. It appears the disease is spreading — it has been detected up the Snake River as far as Hell's Canyon. As yet no control is possible.

In 1986, biologists continued tests to determine the parasite's life cycle. Assuming the organism uses an intermediate host, they used a fluorescent antibody to search for infective stages in various freshwater invertebrates. They also exposed fish to an infected microhabitat in the laboratory. Infections have developed in fish by the presence of certain freshwater mussels.

The project also investigated bacterial kidney disease in ocean-caught salmon and adult spring chinook in the lower Columbia during the year. The portion of the project investigating the transmission of the IHN virus at Round Butte Hatchery was discontinued in 1986. A very low incidence of the virus among returning adults did not allow a definitive experiment.

Studies are scheduled for completion in 1987.

Pen Rearing and Imprinting of Fall Chinook Salmon (83-313)

This project is testing a method of enhancing salmon and steelhead populations in the upper reaches of the Columbia Basin. The U.S. Fish and Wildlife Service transfers salmon fingerlings from hatcheries to selected backwater locations on the mainstem Columbia. Here biologists rear the fish in net pens. In addition to making the best possible use of available backwater rearing areas, this 8-year study will attempt to show that pen rearing is one cost-effective method of artificial salmon production.

WES TAFT

Oregon State University laboratory, Corvallis, Oregon: Examining protein gels for signs of viral infections.

The project team first surveyed several backwater areas from John Day Dam to Priest Rapids Dam, and selected two areas as primary study sites, Rock Creek and Social Security Pond. This was the third year of rearing and releasing fall chinook at these sites, which have not been adversely affected by hydroelectric development. Fish are tagged with coded wire tags.

If the methodology proves feasible, and adult upriver bright fall chinook salmon return to the selected spawning grounds, the pen rearing technique could be applied throughout the Columbia River Basin. Returning adults will be available for harvest by the Indian fishery, for broodstock in subsequent off-station rearing projects, and for outplanting in nearby rivers and streams. The project is expected to run through 1990.

Low Technology Fisheries Facilities for the Enhancement of Anadromous Salmonid Stocks on the Nez Perce Reservation (83-350)

The development and operation of the Columbia River hydroelectric system has almost destroyed the salmon and steelhead fishery of the Nez Perce Tribe. Through this project, the tribe is rebuilding the fishery by constructing low-cost facilities for spawning, incubating, and rearing spring chinook and steelhead.

Tribal biologists evaluated several potential sites on the reservation before proceeding with the design phase. They coordinated siting and preliminary design of the low-capital, low-technology facilities with the Lower Snake River Compensation Plan, Idaho Department of Fish and Game (IDFG), and the Columbia River Inter-Tribal Fish Commission.

However, as the project moved toward completion, a disagreement arose between the tribe and IDFG over how the use of production should be managed and what stocks should be produced. Construction has been deferred until 1989, while the co-management issue is resolved.

Development of Diets for Enhanced Survival of Salmon (83-363)

This project is investigating and comparing the potential benefits of 2 methods of processing fish food. Traditionally, fish food is made from relatively low-quality (and low priced) components which tend to be rancid and heat denatured. This project is producing and testing a diet from a cold vacuum process and comparing results to OMP-2 and OMP-4 diets and other closed formula diets.

Researchers have tested the relative nutritional values of vacuum-dried food on chinook fingerlings. The improved diet can be used in artificial production throughout the Columbia Basin.

ODFW biologists will evaluate the effect of the new diet on the survival and return of coho and chinook salmon. They have tagged selected coho smolts with coded wires for the first 3 release years. Diet development continued in 1986, and coded wire tag recoveries will continue through 1993, when final diet recommendations will be available.

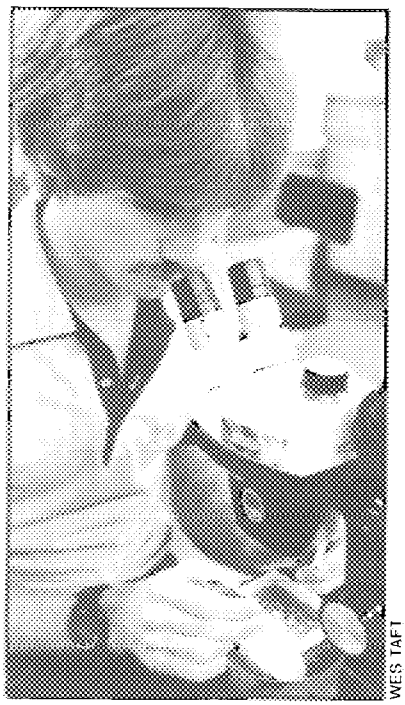
Evaluation of Low Cost Salmon Production Facilities (83-364)

Before the Clatsop Economic Development Committee (CEDC) began its Youngs Bay salmon enhancement program in 1976, fishermen caught fewer than 100 fall chinook there each year. In recent years, the annual catch has averaged 5,500. In 1976, the annual coho catch was less than 10,000 — in 1986 it was more than 50,000.

To determine how much the CEDC project has contributed to those increases, researchers are now examining the effectiveness of various project components. They are rearing, tagging, and releasing coho and fall chinook in an experiment to produce large numbers of salmon at low cost while maintaining genetic diversity.

The project team is determining the best density level for juvenile fish reared in a hatchery and comparing the quality of fish produced in a natural pond environment with those reared in concrete hatchery troughs and ponds. They are also assessing whether these methods could be employed at other low-cost salmon production facilities in the Basin, and are exploring the benefits of community involvement in such projects.

Evaluation work continued in 1986. By its completion in 1989, the study will assess the feasibility of establishing low-cost salmon production facilities as a means to offset Columbia Basin fish losses.



WES TAFT

Oregon State University laboratory, Corvallis, Oregon. Looking for evidence of a killer parasite in salmon tissues.

Minthorn Springs Creek and Bonifer Springs Creek Summer Steelhead Juvenile Release and Adult Collection Facility (83-435)

Damming the Umatilla River for irrigation cut off upstream passage to fish and reduced river flows during migration months for many years. Indian and non-Indian fisheries in the Umatilla Basin suffered badly. Large areas of formerly productive natural spawning and rearing habitat remain but are presently underused.

The Minthorn fish facility on the Umatilla Reservation was completed in 1985, and a similar facility at Bonifer Springs opened in 1983. The Umatilla Tribe uses these on-reservation facilities to acclimate and release juvenile steelhead and chinook and collect and hold returning adults for spawning. Tribal biologists transport eggs to off-reservation mother hatcheries and also incubate eggs in hatch boxes, then release the fry to mature in the underused rearing areas.

Biologists will use these facilities to reestablish Umatilla runs, which they hope will eventually reach 20,000 chinook and 10,000 steelhead annually. This Bonneville-funded project provides for the operation, maintenance, and monitoring of the facilities.

Stock Identification of Columbia River Chinook Salmon and Steelhead Trout (83-451)

Oregon State University researchers completed this study analyzing each wild and hatchery stock in the Columbia River Basin. They characterized 56 stocks of steelhead trout and 57 stocks of chinook salmon by morphological, behavioral, physical, and biochemical traits such as migration timing, migration habits, fecundity, disease resistance, and various enzymes.

Biologists sampled fish over a 3-year period at more than 80 hatcheries in Oregon, Washington, Idaho, and Montana, and in 30 rivers in the Columbia and Snake River systems.

Results will help hatchery and fishery managers protect the genetic integrity of Columbia chinook salmon and steelhead trout. Data will be used in selecting donor stocks for hatchery programs and supplementing wild populations.

Protection of Wild Adult Steelhead in Idaho by Adipose Fin Removal (84-2)

Steelhead reared in hatcheries in the Snake River produce harvestable surpluses. If fishing is allowed, there is a great danger that already threatened wild steelhead stocks would be further depleted. However, it would be possible to protect wild fish stocks if they could be easily distinguished from hatchery fish. Preserving and enhancing wild upriver anadromous fish runs is a high priority in the Council's Fish and Wildlife Program.

In this 5-year demonstration project, Idaho Department of Fish and Game is marking some six million hatchery fish each year — 99 percent of all hatchery fish in Idaho — by surgically removing the adipose fin. The operation apparently does not cause significant adverse effects and provides an easily recognizable mark. The study evaluates the impact of the procedure on the well-being and survival of the fish.

The fin clip allows sports fishermen to differentiate between returning wild and hatchery fish. They can selectively harvest hatchery fish while allowing wild fish to escape and spawn. Results through 1986 indicate this demonstration project is succeeding and protecting the wild steelhead. The project runs through 1988 .

Umatilla River Summer Steelhead Hatchery (84-33)

The U.S. Army Corps of Engineers completed preliminary design of a hatchery facility capable of rearing 200,000 summer steelhead smolts for annual release into the Umatilla River via the Minthorn Springs and Bonifer Springs acclimation facilities.

The Bonneville-funded hatchery — near the existing Irrigon hatchery — will help make up for fish losses resulting from mainstem Columbia River hydroelectric development. A separate project will estimate the potential benefits from the hatchery releases. Construction is scheduled to begin in late 1988 or 1989.

Development of a Subunit Vaccine Against IHN (84-43)

Oregon State University biologists are investigating how to produce a previously developed subunit vaccine against the IHN virus through genetic engineering. IHN proteins are produced by gene-spliced bacterial clones and used to induce immunity to IHN in salmon and steelhead. Experiments with hatchery fish and also with laboratory-reared rainbow trout, steelhead trout, and sockeye salmon will determine how effective induced immunity is in protecting the fish.

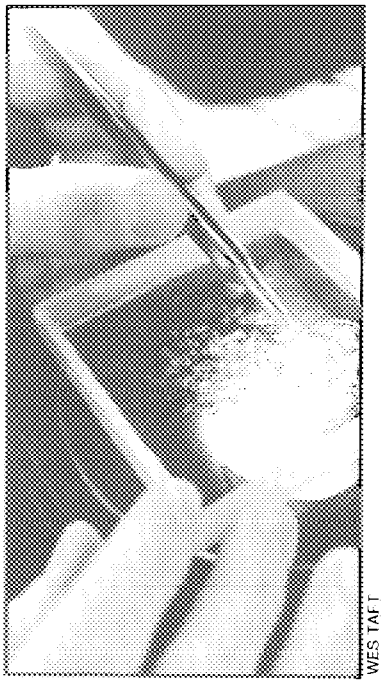
Biologists are also evaluating various methods for immunizing fish against IHN and developing protocols for vaccine production through evaluation of various cloning processes. Immunization trials began in 1986 with purified viral glycoprotein, which protected steelhead against lethal doses of IHN virus.

Influence of Vitamin Nutrition on the Immunity Response of Hatchery-reared Salmonids (84-45, 84-945)

Increased levels of certain vitamins help protect man and domestic animals from infectious diseases. Now there is evidence this is also true of hatchery-reared fish. This aim of this study is to establish the amounts of six vitamins — C, B6, E, folic acid, pantothenic acid, and riboflavin — required to optimally protect Columbia Basin salmonids from disease.

Microbiologists are collaborating on these projects, which will also develop recommendations on how to manufacture, store, and handle practical, economical, vitamin-enriched fish feeds for use at hatcheries.

Biologists last year developed or improved assays for testing production of disease resistance in fish. The outcome of the work, which runs through 1989, should be a better, more economical salmon diet, more adult hatchery-reared salmon, and more efficient mitigation for losses from hydroelectric development.



WES TAFT

Oregon State University laboratory, Corvallis, Oregon: In 1986, 18 percent of BPA's budget supported efforts to block salmon disease.

Evaluate Vaccines for Bacterial Kidney Disease in Salmon (84-46); EPA Facility Support for BKD Vaccine Testing in Salmon (86-96)

Bacterial kidney disease infects large numbers of hatchery-reared salmon and trout, causing heavy losses. In an effort to combat this deadly disease, immunologists are examining the components of the infectious agent and testing whether they can induce immunity against BKD (84-46).

Intercellular antigens are being tested both in natural molecular form and in chemically modified forms that will promote immunity. Researchers rank the antigen preparations by effectiveness, cost of vaccine production, and technical difficulties involved.

The study concludes in 1987. The final report will fully describe production protocols and give suggestions for large-scale vaccine production for each antigen proved capable of providing a significant degree of protection against BKD.

To test antigens more efficiently, the team required additional tanks for holding test fish, which were not available at the OSU fish disease lab. To solve this problem, the U.S. Environmental Protection Agency, with Bonneville funding, provides the team with water and laboratory space at the EPA fish testing facility in Corvallis (86-96).

Willamette Spring Chinook Study Plan (85-58)

Oregon Department of Fish and Wildlife researchers are conducting this study to determine the most effective methods for supplementing natural stocks of spring chinook in the Willamette River system with hatchery-produced fish.

The study team completed review of all existing literature on the subject in 1985. In field experiments, they will introduce hatchery-reared spring chinook into natural streams as adults, fry, or presmolts to evaluate the production obtained.

At Bonneville's request, ODFW revised phase two plans when it was realized several test streams were to undergo habitat enhancement during the 9-year life of the project. Bonneville contracted with a consultant to conduct a major technical review of the program during 1986.

Anadromous Fish Health Monitoring in Washington (86-13, 86-54)

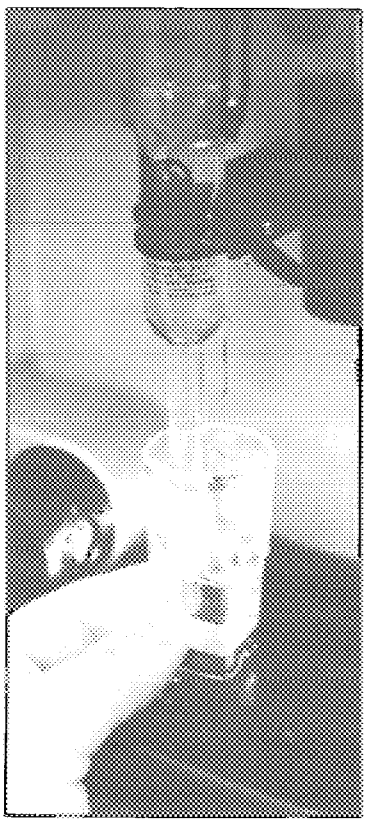
These projects are part of Bonneville's efforts to document information on fish health in the more than 70 hatcheries in the Columbia Basin. This is probably one of the most comprehensive fish health monitoring programs in the world.

Accurate fish health data helps Bonneville and hatchery managers plan changes and introduce new techniques that will increase survival rates in artificial propagation facilities.

Washington Department of Game (86-13) and Washington Department of Fisheries (86-54) are monitoring the health of salmon and steelhead reared at hatcheries throughout the state. Studies include physiological analyses of fish condition, tests for pathogens and parasites, and analysis of hatchery water supplies.

A complete fish health profile of artificially produced salmon and steelhead should be ready by 1991. Similar augmented fish health monitoring contracts are currently being negotiated with Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service.

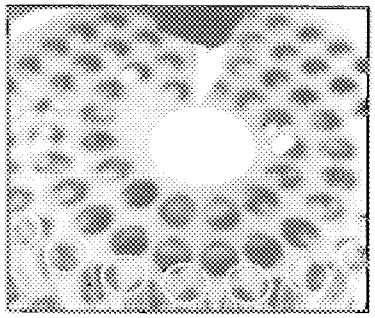
John Day Acclimation Pond (86-82)



When John Day Dam was constructed, some 30,000 bright fall chinook lost their upriver spawning habitat through inundation. To make up for the loss, Spring Creek and Bonneville fish hatcheries were expanded, and in 1982 fisheries agencies started rearing bright fall chinook for release above the dam. Over the next few years they will release over 16 million fingerlings annually.

Since the hatcheries are not located near John Day Dam, fish must be trucked to the release points, a procedure that subjects them to considerable stress. To improve their chances of survival they need time to recover from the stress of hauling. They also need to acclimate to the release environment to develop the homing cues that will eventually guide them back to spawn there.

At present, no acclimation facility exists in the area, so the U.S. Fish and Wildlife Service is conducting detailed surveys of 10 potential sites. The survey team will present their report in October 1987, when fishery agencies and tribes will begin final site selection.



Oregon Health Sciences University, Portland, Oregon: Researchers are developing tests and vaccines to more quickly detect and control bacterial diseases. WES TAFT

Habitat and Passage Improvement: Project Descriptions

Habitat Quality and Anadromous Fish Production Potential on the Warm Springs Indian Reservation (81-108)

A Biological and Physical Inventory of the Streams within the Nez Perce Reservation (82-1)

Snake River Fall Chinook Brood Program (82-7)

Yakima River Spring Chinook Enhancement Study (82-16)

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Habitat Enhancement: Collawash Falls, Fish, Wash, and Lake Branch Creeks, and Fifteenmile Creek (84-11)

Habitat Enhancement: Fifteenmile Creek (86-79)

Salmon River Habitat Enhancement (84-24)

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Three Mile Diversion Dam Fish Passage Facilities, Umatilla River (83-436)

Clearwater River Habitat Enhancement (84-6)

Joseph Creek/Grande Ronde River Habitat Enhancement (84-9, 84-25)

John Day River Habitat Enhancement: Mainstem, Middle Fork (84-21)

John Day River Habitat Enhancement: East Fork Beech Creek, Canyon, Big Boulder, Granite Boulder Creeks (84-22)

Camas Creek Habitat Enhancement (84-23)

Lemhi River Habitat Enhancement (84-28)

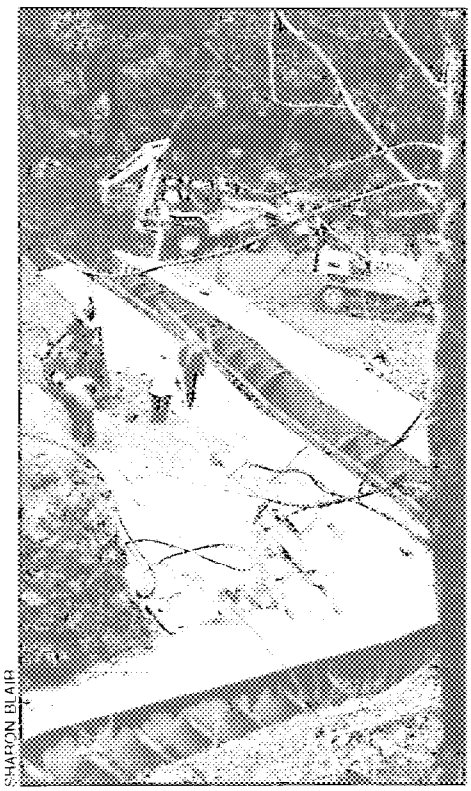
Tumwater/Dryden Dams Fish Passage (85-52, 85-53)

South Fork John Day River Passage Improvement: Mainstem and Izee Falls (85-71)

Little Naches River Passage (86-75)

Habitat Evaluation and Monitoring — Columbia River Basin (86-78)

Little Fall Creek Fish Passage (86-90, 86-124)



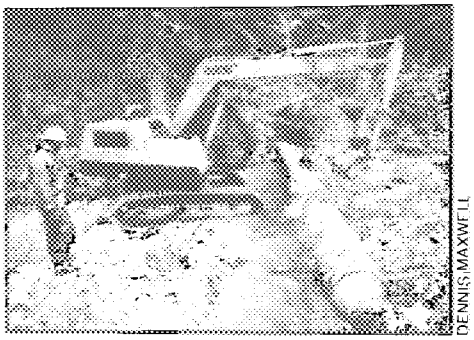
Lane County, Oregon. Little Fall Creek's fish ladder will open up 12 miles of habitat and yield 400 more adult salmon each year.

OPPOSITE: Cowlitz Salmon Hatchery, Salkum, Washington. Isolating salmon eggs prevents the spread of infectious hematopoietic necrosis virus. WES TAFT

Habitat Quality and Anadromous Fish Production Potential on the Warm Springs Indian Reservation (81-108)

The Natural Resources Department of the Confederated Tribes of Warm Springs began this project in 1981 to improve habitat and passage for salmon and steelhead on reservation streams and rivers. Tribal biologists have evaluated potential spawning and rearing areas and calculated the number of adults that must escape to seed the available habitat.

In 1986, tribal biologists continued to identify habitat and passage problems and develop plans for improvements. Work was completed on enhancing chinook salmon and steelhead rearing habitat on channelized sections of Beaver Creek. The biologists will evaluate the success of the habitat improvements.



DENNIS MAXWELL

Red River, Idaho: Foresters install a log weir to improve salmon spawning habitat.

A Biological and Physical Inventory of the Streams within the Nez Perce Reservation (82-1)

As part of the effort to rebuild their salmon and steelhead fisheries, which have suffered drastically from hydro development, the Nez Perce Tribes of Idaho have prepared an inventory of both the physical habitat in reservation streams and the associated biological community.

They have identified factors that limit fish production, such as heavy sedimentation, high summer water temperatures, low flows, and barriers to migration. The tribe will use this information to select the most appropriate enhancement efforts for each stream in the reservation. The study concluded in 1986.

Snake River Fall Chinook Brood Program (82-7)

The Snake River fall chinook population has declined to critically low levels. To preserve the unique genetic traits of this upper river run, the National Marine Fisheries Service started an experimental fish farm to produce some of the eggs needed by Snake River hatcheries. The goal was to produce 8.5 million eggs annually by 1987.

However, a newly identified marine pathogen (Rosette disease) killed most of the fish reared under this project before they reached maturity. Given the severe disease problem, the brood stock program was terminated in 1986.

Yakima River Spring Chinook Enhancement Study (82-16)

Yakima River spring chinook have declined drastically, due to overharvest, withdrawal of water for irrigation, and downstream hydro development. This study is investigating methods of rebuilding the salmon runs while maintaining the genetic components of naturally producing stocks.

In this project, Yakima Tribe fishery researchers are estimating the numbers and distribution of naturally produced fry and smolts in the river. They are evaluating different methods of introducing hatchery fish into the natural rearing environment, e.g. testing the efficiency of acclimation ponds versus direct transportation from the hatchery.

The next task is to locate and define areas of the watershed suitable for rearing spring chinook. Then the project team will develop strategies for enhancing the fishery and prepare guidelines for compensating for fish losses in the Yakima Basin. The study is due for completion in 1990.

Idaho Habitat Evaluation for Offsite Mitigation Record (83-7)

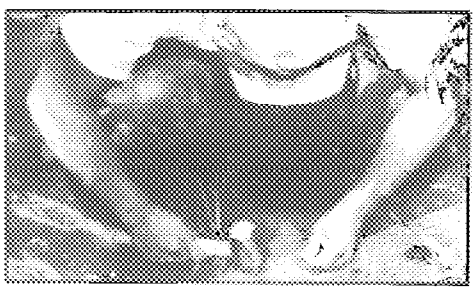
Habitat improvement projects have been widely used to increase chinook and steelhead populations in the Clearwater and Salmon River basins in Idaho, where human activities have degraded or destroyed spawning and rearing grounds. Though it is generally accepted that habitat projects are effective, the increased natural production and cost/benefits have never been quantified in the field. This is needed to produce a record of credit for offsite mitigation in Idaho.

In this 7-year project, the state's Department of Fish and Game is evaluating what benefits habitat improvements bring to anadromous fish production in the basin. Biologists estimate the number of juvenile and/or adults per mile and relate the figures to construction and operating costs per mile over each project's useful life.

They are evaluating 9 projects, all built by the U.S. Forest Service, the Shoshone-Bannock Tribes, and the IDFG. The Idaho offsite mitigation record is prepared annually, though individual projects are monitored only at intervals through 1989.

Hood River Passage (83-341)

Man-made barriers are not the only obstacles fish meet when trying to return upstream to spawn — nature can also block their path, as happened on the West Fork Hood River in Oregon. Once, summer steelhead and spring chinook had access to over 23 miles of prime habitat above the West Fork Falls, making it one of the most productive areas for wild fish in the Hood River system.



DENNIS MAXWELL

Clearwater River, Idaho: A worker tacks hardware cloth onto a log weir which will trap gravels and create a new spawning site.

Over the past 10 to 15 years, however, rushing waters cut through about 5 feet of hardened volcanic ash on the streambed. This exposed a 16-foot layer of loose sand and gravel which gradually eroded, creating a 12-foot waterfall.

Few if any fish were able to leap over this natural barrier, which was moving upstream about 5 feet every year as further erosion occurred. It became known as Moving Falls. Each year, hundreds of fish would gather helplessly in the pool at the base of the falls, a favorite spot for poachers.

Oregon Department of Fish and Wildlife engineers in 1986 completed a huge fish ladder that has turned the falls into a gentle cascade, easily negotiated by adult fish on their way to spawn. One of the first of its kind in the region, this giant stairway consists of 10 concrete weirs 8 to 15 feet long, separated by wire baskets filled with rocks (called gabions) to help stabilize the streambed.

Now all the returning fish have access to the 23 miles of excellent habitat above the falls. Biologists estimate the ladder will increase the West Fork's steelhead population by 1,400 adults a year.

Anadromous Salmonid Spawning and Rearing Habitat in Bear Valley Creek (83-359)

Bear Valley Creek, a tributary of the Upper Middle Fork of the Salmon River in central Idaho, has been a valuable area for natural production of wild salmon and steelhead. The area once produced 90 percent of the Middle Fork's wild salmon runs, with some 2,400 adults returning every year.

But dredge-mining operations during the late 1950s degraded the habitat, removing and burying spawning gravels, filling pools with sediment, and eliminating streambank vegetation. Adult salmon returning to spawn have numbered perhaps 100 in recent years.

The Shoshone-Bannock Tribes, whose traditional fishing in the area has been virtually eliminated, formed a task force of tribal, state, and Federal representatives to cooperate in enhancing the habitat. They are also addressing similar problems at Yankee Fork and Jordan Creek on the Middle Fork and on the East Fork Salmon River.

Tribal researchers have performed a habitat inventory and prepared cost estimates. They have designed and evaluated enhancement measures to arrest lateral channel movement and sedimentation, coordinating the work with Federal and private landowners. One landowner, Bear Valley Minerals, provided technical support and easements to the work site. BVM had acquired the property after the damage was done. Engineers started rehabilitation work in 1986, while the tribal biologist continued to monitor biological conditions to determine the effects of remedial measures over time. Construction will continue into 1988.

Planning and stream inventory also continued at Yankee Fork and Jordan Creek and on the East Fork. Construction on Yankee Fork may begin in 1987.

Though habitat degradation in this case is unrelated to hydroelectric development or operation, the protection of these wild stocks of salmon and steelhead is still considered offsite mitigation for mainstem fish losses.

Alturas Lake Creek Flow Augmentation (83-415)

Alturas Lake Creek is a tributary to the Upper Salmon River with its source at almost 9,000 feet elevation in the Sawtooth National Forest. The stream was once a prime spawning site for chinook and sockeye salmon, but an irrigation diversion dam now diverts flows during the spawning season, blocking passage upstream to Alturas Lake. Migrating salmon populations are at less than half their previous levels.

Increasing streamflows would allow migrating fish to reach spawning grounds while improving both the quality and quantity of spawning and rearing habitat below the dam.

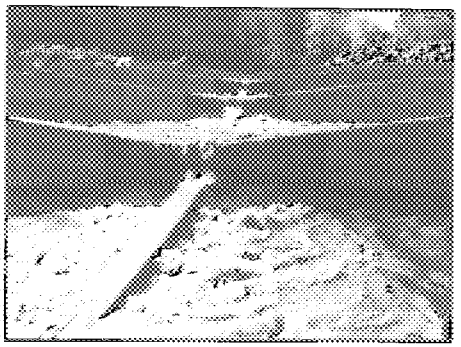
The U.S. Forest Service, in collaboration with other agencies, has examined alternative approaches to provide and maintain adequate instream flows in the creek. The Council's Fish and Wildlife Program called for a storage dam to improve flows and provide passage, but the Sawtooth National Forest recommends acquiring the private landowner's water rights. Negotiations are underway to develop a more efficient irrigation system for the landowner and to legally secure the surplus water right.

Meanwhile, the landowner is planning to improve irrigation efficiency by converting from flood to sprinkler systems and will subsequently draw water from the Snake River instead of Alturas Lake Creek. Biologists predict the number of young chinook will increase to over 700,000 annually and sockeye could increase to somewhere between 300,000 and 900,000 annually.

Red River/Crooked River Fish Passage Habitat Improvements (84-5)

In an effort to increase natural production of steelhead and chinook salmon in the South Fork Clearwater River drainage, Nez Perce National Forest engineers are improving habitat at 3 sites.

They have already replaced a culvert so that fish can reach upstream spawning areas on the Crooked River and are currently correcting habitat problems resulting from past dredge-mining operations. Enhancement techniques include the creation of rearing pools, placement of instream cover, and replanting of streamside vegetation.



SHARON BLAIR

Hood River, Oregon: A new fish ladder could mean 2,000 more steelhead each year for the Columbia.

USFS is cooperating with Idaho Department of Fish and Game and local landowners to improve habitat on Red River. Habitat has been degraded by past mining activity and heavy grazing on private ranches. Engineers are planting trees and shrubs to stabilize the banks and fencing streamside areas on private ranch land to encourage the growth of plants that provide cover for young fish. These measures could increase production potential to 3 or 4 times the current levels.

Meadow Creek is another site with excellent potential for increased natural chinook and steelhead production, but falls and boulder cascades near the creek mouth hindered passage to spawners. USFS engineers have made the barriers passable by blasting rock. This has enlarged pools, cleaned the faces of the falls, and broken up large boulders for relocation. The team has also built rock weirs and placed log structures in the stream.

Work at these sites continues through 1989.

John Day River Habitat Enhancement (84-8)

Umatilla National Forest fish biologists continued habitat work on the North Fork John Day River and its tributaries during 1986.

On the mainstem North Fork, biologists continued the work of opening blocked natural side channels for fish rearing. On two tributaries — Desolation and Wilson Creeks — they are constructing juvenile rearing habitat and adult resting pools and stabilizing streambeds to improve the quality and quantity of spawning areas. During the year the team also began surveying a 30-mile stretch of potential habitat on Fivemile Creek and designing a plan to improve spawning and rearing conditions.

Habitat Enhancement: Collawash Falls, Fish, Wash, and Lake Branch Creeks, and Fifteenmile Creek (84-11); Habitat Enhancement: Fifteenmile Creek (86-79)

Mount Hood National Forest biologists are improving passage and habitat for coho salmon and winter and summer steelhead in several creeks in the Northern Cascades (84-11).

At Fish and Wash Creeks, they have reestablished an off-channel coho rearing pond where young coho can grow until ready to migrate. They have also installed log weirs to trap gravels for spawning.

On Lake Branch Creek, crews have removed logjams and installed gravel-trapping structures, which could help double fish production. Current activities include blasting pools in lower Lake Branch and installing instream structures in McGee Creek.

There are plans for a fish passageway at Collawash Falls to give access to 8.4 miles of habitat in the upper Collawash River. Engineering feasibility studies were conducted in 1986, and construction is due to start in 1987. On the Hot Springs Fork of the Collawash River, engineers are facilitating fish passage at a 9-foot falls and installing structures to improve spawning habitat and effective cover.

USFS (84-11) and Oregon Department of Fish and Wildlife (86-79) have started work on improving wild steelhead habitat in Fifteenmile Creek. ODFW estimates some 250 adults return to spawn every year in the creek's basin and that this number could be increased at least eightfold if passage and habitat conditions are improved. Current problems include low summer flows, lack of streamside vegetation, natural and manmade barriers, lack of deep pools, and sedimentation covering spawning gravel.

The project covers 145 miles of habitat in the 7 streams of the Fifteenmile Creek basin.

Salmon River Habitat Enhancement (84-24)

USFS and Bonneville will share the funding of habitat improvements in Marsh, Elk, and Bear Valley Creeks on the upper Salmon River in Idaho. Heavy livestock grazing, irrigation diversions, and natural sedimentation have degraded the salmon and steelhead habitat on these streams.

Biologists have evaluated potential habitat and estimated possible population levels along 150 miles of stream. They have recommended appropriate improvements, such as fencing, stream bank stabilization, and instream structures. Bonneville and USFS are developing a cost-sharing agreement to carry out these recommendations. Construction work will begin in 1987.

Trout Creek Natural Propagation Enhancement (84-7, 84-62, 86-93, 86-94, 86-121)

Anadromous fish populations in Trout Creek, in central Oregon, are severely limited by irrigation withdrawals and stream channelizations that result in low summer flows, high water temperatures, unstable banks, and few spawning pools. Overgrazing on stream banks and stream channelization has also depleted vegetative cover.

The Trout Creek watershed could be a major tributary system for the production of wild salmon and steelhead. The basin currently supports a summer run estimated at 250 steelhead because of degraded habitat. These fish use only 40 miles of stream, leaving another 100 miles virtually unused.

The U.S. Soil Conservation Office (84-7) and Oregon Department of Fish and Wildlife (84-62) in 1986 completed plans for the Trout Creek natural propagation project. Contractors also finalized benefit-cost analyses (86-93, 86-94), and a private consultant held a series of meetings with landowners to reach final agreement on restoration alternatives for each site earmarked for habitat improvements (86-121). Construction work began in the summer of 1986.

Lower Umatilla River Channel Modifications Below Three Mile Dam (83-434); Three Mile Diversion Dam Fish Passage Facilities, Umatilla River (83-436);

Three Mile Dam on the Umatilla River is a significant obstruction to salmon and steelhead migrating to spawning grounds in the upper Umatilla River Basin. The spill flow pattern creates false attraction that draws fish away from fish ladder entrances. In low water years, the resulting migration delay and stranding, along with other problems such as poaching and poor water quality, seriously limit steelhead production in the area. Improperly screened diversions cause high mortality among downstream migrants, further compounding the problem.

Over the years, steelhead runs have declined from several thousand to as low as 750, and the salmon runs had disappeared completely until recently.

The U.S. Bureau of Reclamation, in cooperation with other agencies, is developing final designs for solving passage problems and for adult collection and counting facilities at the dam (83-436). Bureau engineers will replace the east bank ladder and renovate the west bank ladder. Facilities to trap and count adult fish will be added at each ladder. ODFW will then haul adult salmon past the 4 diversion dams above Three Mile Dam. Construction will be completed in 1988.

Another project to improve fish passage to the dam was undertaken in 1984 by the U.S. Army Corps of Engineers (83-434). Engineers modified the lower Umatilla River channel below the dam to allow salmon and steelhead to pass at low flows when blind channels, bedrock drops, and streamwide riffles impede passage. The Corps blasted a trench in the riverbed to connect channels, remove outcrops, and concentrate enough water to allow fish to move up the trench to the dam. The Corps carried out additional work at the site in 1986 to correct problems identified by a review team.

DENNIS MAXWELL

Fish Creek, Oregon: Reworking this Clackamas River tributary will mean more rearing habitat for coho salmon.

Clearwater River Habitat Enhancement (84-6)

Forest Service engineers have completed habitat improvement projects at Lolo, Crooked Fork, and Eldorado Creeks in the Clearwater River Basin. They placed structures in Lolo Creek to create a better spawning and rearing environment for chinook and steelhead and removed rock barriers at Crooked Fork that blocked access to upstream habitat.

El Dorado Creek has a series of natural basalt falls barring upstream passage to spring chinook and steelhead. To allow migration to some 10 miles of spawning and rearing habitat, workers blasted out the barriers and built stairstep pools at the lowermost falls.

Joseph Creek/Grande Ronde River Habitat Enhancement (84-9, 84-25)

Suitable rearing habitat for summer steelhead is severely limited in large portions of the Upper Grande Ronde and Joseph Creek subbasins by poor pool/riffle ratios and high summer water temperatures.

The U.S. Forest Service (84-9) and Oregon Department of Fish and Wildlife (84-25) are improving spawning and rearing habitat on over 120 miles of stream. Workers are installing instream structures to improve pool/riffle ratios. They are planting trees and shrubs to stabilize streambanks and increase overhead cover and building fences to boost plant recovery.

Wallowa Whitman National Forest biologists last year worked on instream structures, fence building and streamside vegetation in Elk, Chesnimnus, and Swamp Creeks. ODFW biologists contacted landowners, conducted surveys, and did construction work in the Upper Grande Ronde and Joseph Creek subbasins.

John Day River Habitat Enhancement: Mainstem, Middle Fork (84-21); John Day River Habitat Enhancement: East Fork Beech Creek, Canyon, Big Boulder, Granite Boulder Creeks (84-22)

Heavy losses at mainstem Columbia River hydro projects have depleted the John Day River's wild chinook and hatchery-supplemented steelhead trout runs. Various other water uses unrelated to hydropower have also affected these runs. Solutions to these problems could contribute much to offsetting losses at mainstem dams.

An ODFW project (84-21) is enhancing habitat along 80 miles of stream on private land. Activities include increasing the number of rearing pools, creating holding areas for adult fish, rebuilding old stream channels damaged by gold dredging in the 1940s, and other habitat and streamside improvements. Construction was underway in the mainstem John Day River and Fox, Deer, and Fivemile creeks.

The U.S. Forest Service is also working on habitat improvements and passage development projects on sections of the John Day River and tributaries that run through Malheur National Forest (84-22). Biologists have installed log and boulder structures to improve the quality and quantity of pool habitat.

Crews have completed work on the upper mainstem, Granite Boulder, East Fork Beech, and Canyon Creeks. During 1986 they continued enhancement activities on the Middle Fork and 7 other tributaries.

Camas Creek Habitat Enhancement (84-23)

Heavy livestock grazing has degraded the channel and streamside habitat of Camas Creek, a 38-mile long tributary of the Middle Fork Salmon River in Idaho. U.S. Forestry Service biologists have completed a feasibility study and plan to enhance salmonid spawning and rearing habitat.

Habitat improvement work is scheduled to begin in 1987. Activities will include fencing and reintroduction of riparian plant species to stabilize stream banks and provide cover. This project will help rebuild populations of wild chinook and steelhead in Camas Creek, which are part of the last remaining pure inland runs of anadromous fish in Idaho.

Lemhi River Habitat Enhancement (84-28)

Large portions of the Lemhi River in Idaho are diverted for irrigation, adversely affecting salmon and steelhead rearing and adult passage. This study by OTT Water Engineers, completed in 1986, identified problem areas on the river, evaluated fishery potential, and developed recommendations for enhancing fish production. The consultant has presented plans for moving returning adults over irrigation dams and increasing rearing areas.

Bonneville has deferred funding for this project.

Tumwater/Dryden Dams Fish Passage (85-52, 85-53)

Construction began in August 1986 on new fish ladders at Dryden and Tumwater dams on the Wenatchee River in central Washington. These facilities will greatly increase the number of salmon and steelhead migrating into traditional upriver spawning grounds. The Wenatchee was once the second largest producer of sockeye salmon in the Columbia River Basin, and chinook, steelhead, and coho have also spawned there. But passage problems have in recent years cut adult spawners by as much as 80 percent.

The Dryden dam was built in the early 1900s as a diversion for irrigation flow and later for hydropower to serve Wenatchee. It originally had fish ladders on both banks, but a flood in 1948 washed out the left bank ladder, which was never replaced. The original right bank ladder proved inadequate for fish passage.

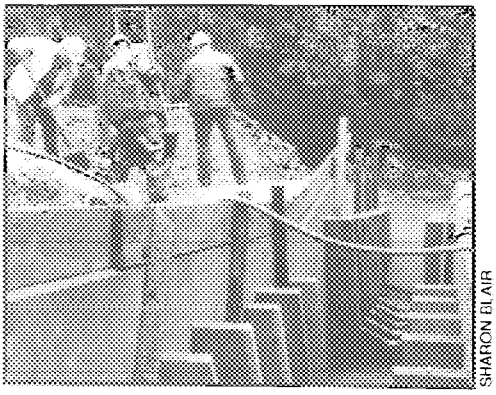
Electricity generated at Tumwater Dam, also built in the early 1900s, provided power for the Great Northern Railroad to move its electric railway over Stevens Pass in the Cascade Mountains. The Tumwater fish ladder, last worked on in the 1940s, also needs a complete overhaul.

Neither dam has produced power since Chelan County PUD purchased them in 1957. However, the utility maintains them for possible future development. The fish passage projects are scheduled for completion in March 1987.

South Fork John Day River Passage Improvement: Mainstem and Izee Falls (85-71)

The Bureau of Land Management completed rehabilitation work on the South Fork John Day River to improve summer steelhead spawning habitat. Poor pool habitat, low summer flows, and high water temperature limit wild summer steelhead production.

Crews placed 1,500 boulders in the river to increase the quality, quantity, and diversity of scour pools in 10.5 miles of stream below Izee Falls.



SHARON BLAIR

Lane County, Oregon: Workers put the finishing touches on Little Fall Creek fish ladder.

Little Naches River Passage (86-75)

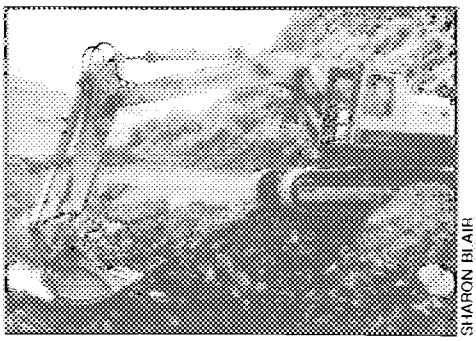
Engineers contracted by the U.S. Forest Service completed preliminary designs for a fishway to help adult salmon and steelhead past Salmon Falls, a natural barrier on the Little Naches River. They will complete the final design and construction phases during 1987.

Crews started work on rehabilitating a 3,000-foot stretch of the Little Naches below the falls which had been damaged by floods. They deepened the channel by installing instream flow deflectors to allow a passage corridor to the fishway and will next replant the streambanks with vegetation.

Building the fishway will open up some 20 miles of previously unused anadromous fish habitat, enough to support production of over 75,000 chinook, coho, and steelhead smolts each year. The Yakima Indian Nation and fish and wildlife agencies plan initial releases of hatchery fish into the rearing areas, which will be gradually phased out as the runs become self-sustaining.

Habitat Evaluation and Monitoring — Columbia River Basin (86-78)

Bonneville has contracted a consultant to review and analyze results of 31 habitat and passage improvement projects conducted in Oregon, Washington and Idaho between 1982 and 1984. The contractor developed a standard format for summarizing information from annual and final project reports.



SHARON BLAIR

Trout Creek, Oregon: Reworking 80 stream miles will bring another 4,000 wild adult steelhead to this Deschutes River tributary each year.

Little Fall Creek Fish Passage (86-90, 86-124)

Two natural barriers impede fish passage to over 12 miles of spawning habitat on Little Fall Creek, a tributary of the Willamette River near Springfield, Oregon. Willamette National Forest contracted with Oregon Department of Fish and Wildlife in 1981 to develop original design specifications for this passage project, which is located on Weyerhauser Company lands.

Bonneville contracted with Weyerhauser to construct a fish ladder over a 24-foot falls and to blast jump pools to help migrating salmon and steelhead jump a second 8-foot falls on the creek. ODFW provided periodic engineering inspections.

In addition to the Bonneville-funded passage improvements, Willamette National Forest is funding habitat improvement activities above the falls, and ODFW has started stocking the creek with chinook and steelhead fry. The steelhead run will be left to sustain itself, while the chinook run will be supplemented with hatchery fish for the next few years. The projects will eventually add 12,000 young fish to the Willamette each year.

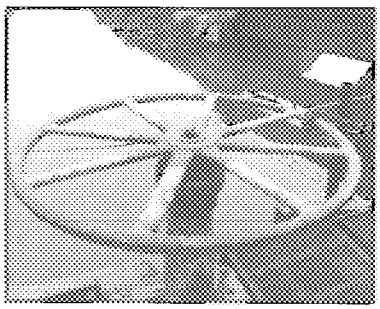
Yakima Basin Passage Program

Yakima Basin Fish Passage Enhancement (84-57, 84-58, 85-62, 85-85, 86-65, 86-88, 86-89, 86-91, 86-112)

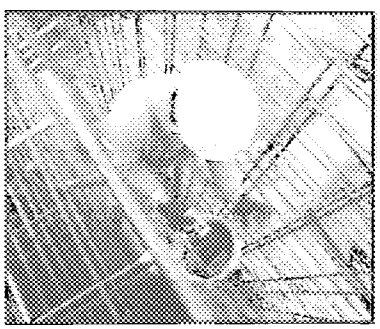
Bonneville and the Bureau of Reclamation are administering the installation or renovation of fish passage facilities at 20 sites in the Yakima Basin in a major rehabilitation program.

Contractors last year built ladders and fish screens at the diversion dams and main canals of Wapato Diversion Dam (84-57) and a ladder and screen at the Satus Unit Diversion Dam on Toppenish Creek (84-58).

In another project (85-85), Washington State University made channel modifications at Toppenish Creek to provide passage for migratory fish into the creek headwaters. Fish screens will be installed on the Toppenish diversion canal in 1987.



Construction was completed in 1985 on fish screens at Sunnyside Canal and at the Richland Canal at Horn Rapids Dam. The screens direct downstream migrants, diverted from the Yakima River by irrigation flows, back into the river channel. A project to evaluate the effectiveness of these fish screens (85-62) indicates that 100 percent of the fish are passing the Sunnyside screen safely. A similar study evaluated effectiveness of the Toppenish/Satus screen in 1986 and will evaluate the Wapato screens in 1987.

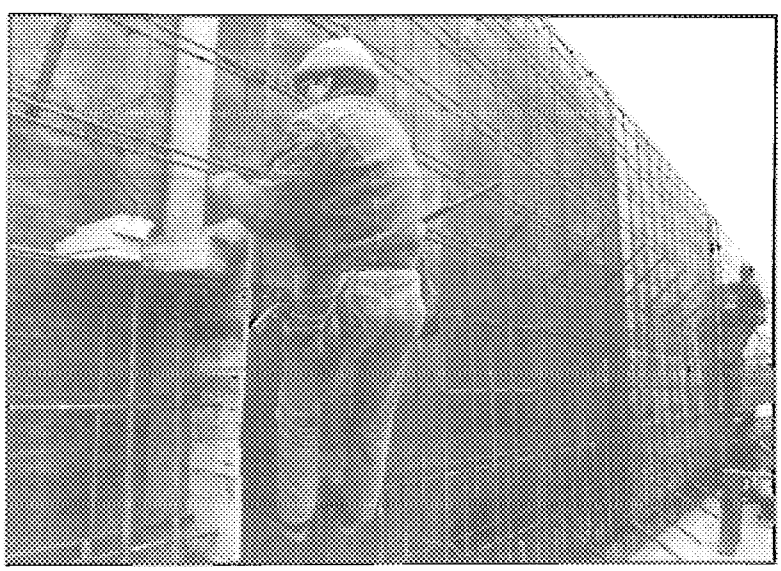


Three ladders at Sunnyside Dam are also in place.

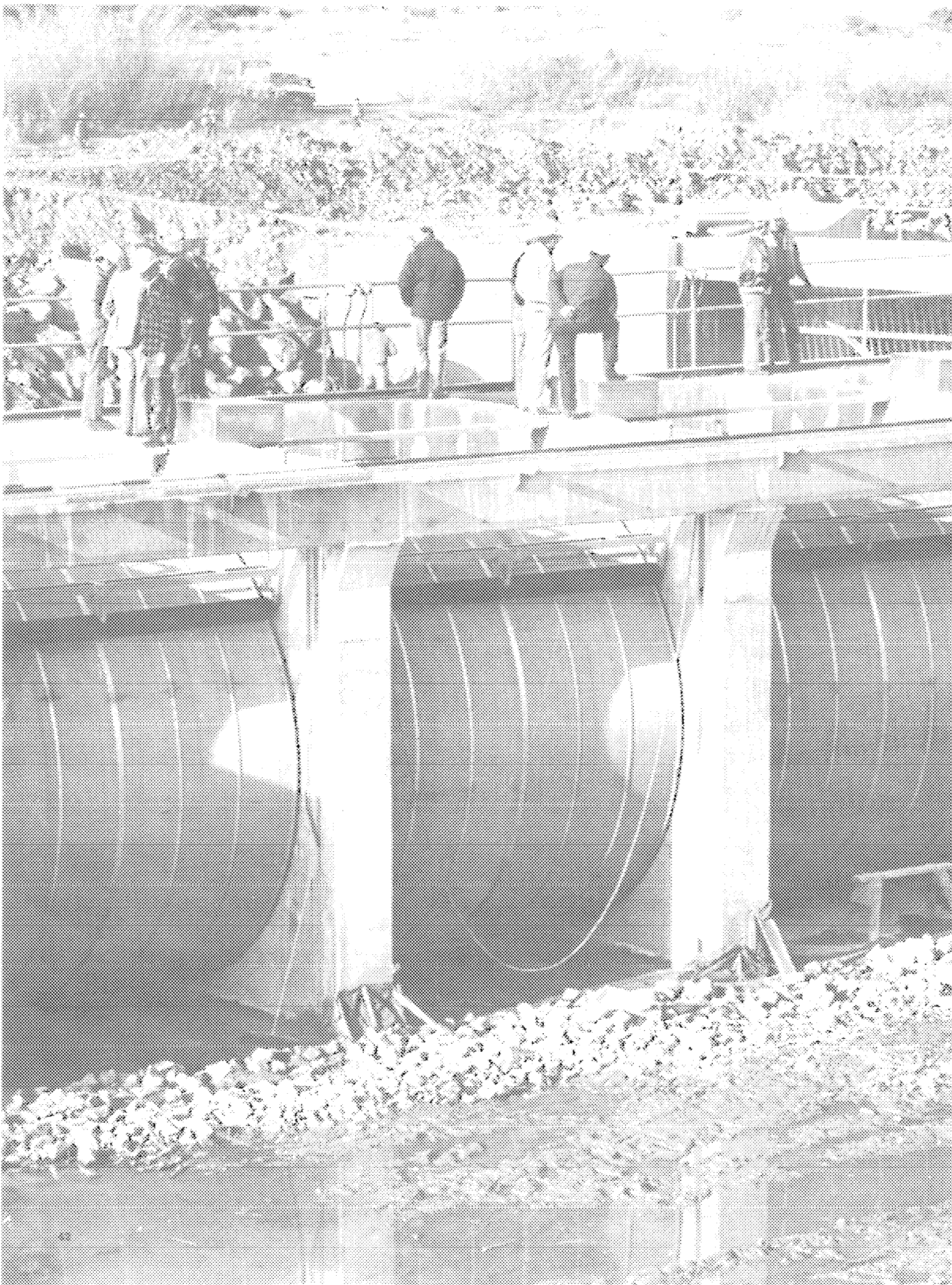
The USBR is completing predesign evaluations on fish passage improvements at a further 5 sites - Taneum Diversion, Snipes/Allen Canal, Westside Ditch, Thorpe Mill Ditch, and Ellensburg Town Diversion (86-91).

Engineers started design work last summer on fish screens at Snipes/Allen, Westside, and Marion Drain (86-65); and began construction of a ladder at Satus Creek (86-88). Washington Department of Fisheries is fabricating the fish screens to be installed at the Toppenish, Westside, and Ellensburg sites (86-112).

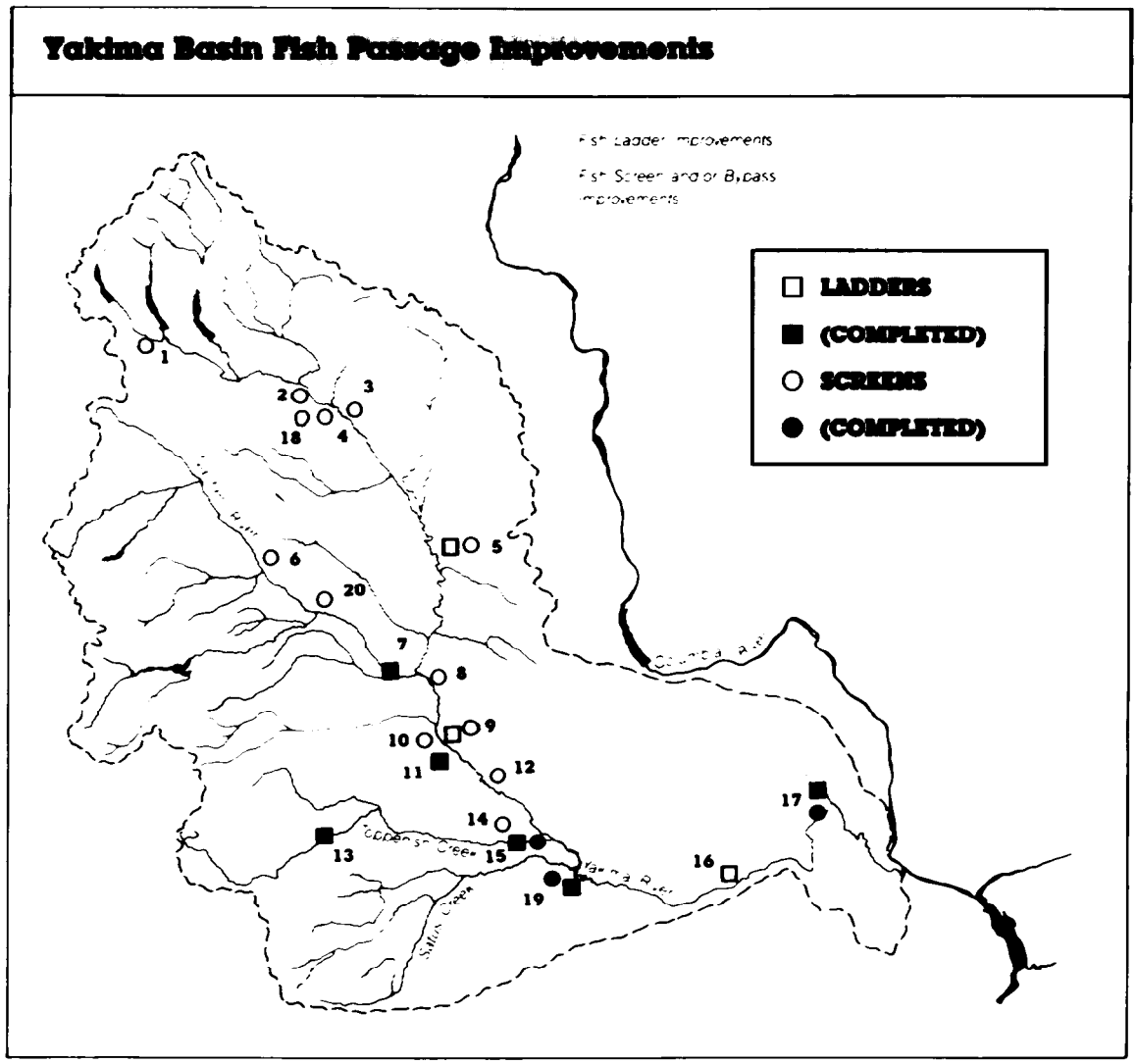
Yakima Basin, Washington: Irrigation canals and dams such as the Satus Unit on Toppenish Creek (TOP) will get new ladders and screens like the ones being built at Sunnyside (BOTTOM, RIGHT) to help salmon move into historically bountiful salmon habitat.
BRYAN PETERSON



OPPOSITE: Sunnyside, Washington: Workers scale reinforcement framework for a new fish ladder.
BRYAN PETERSON



MAP OF YAKIMA RIVER BASIN



Ladders
Screens
(Darkened symbols indicate completed projects)

1. Easton Diversion Dam (Bureau of Reclamation)
2. Westside Canal Diversion
3. Thorpe Mill Diversion (Bureau of Reclamation)
4. Town Diversion Dam
5. Roza Diversion Dam (Bureau of Reclamation)
6. Stevens Ditch Diversion
7. Natches Cowiche Diversion (Bureau of Reclamation)
8. Roza Powerplant Wasteway (Bureau of Reclamation)
9. Wapato Diversion Dam
10. Old Reservation Canal Diversion
11. Sunnyside Diversion Dam
12. Snipes Allen Diversion
13. Toppenish Creek Diversion
14. Marion Drain Diversion
15. Toppenish Creek Satus Unit Diversion
16. Prosser Diversion Dam (Bureau of Reclamation)
17. Horn Rapids Diversion Dam
18. Taneum Diversion Dam (Bureau of Reclamation)
19. Satus Creek Diversion
20. Wapatox Diversion Dam (Pacific Power & Light)

OPPOSITE:
Yakima Basin, Washington: The Yakima study team inspects the Sunnyside screens — finished on time and under budget. SHARON BLAIR

Upriver Game Fish

In the School of Fisheries laboratory at the University of Washington, a team of researchers is studying an ancient and mysterious species of migrating fish which they think has been forced to change its behavior patterns because of man's intervention.

Biologically anadromous, the Columbia River white sturgeon once migrated upstream in fall and downstream in late winter or spring. Hydroelectric dams now block these routes. This fish has been forced to adapt to a radically changed habitat. Since they do not use fish ladders built for salmon, sturgeon are now restricted to stretches of the Columbia and Snake Rivers between the dams, where isolated populations inhabit the reservoir pools.

Biologists until now have known little about the sturgeon's basic biology. Bonneville last year funded 3 projects to broaden existing knowledge of this species and develop ways to make up for the adverse impacts of the hydro system.

Hydroelectric facilities and their operations affect all species of resident game fish that spend their lives in the fresh waters of the Columbia Basin. At least 20 species develop, mature, and reproduce in the basin.

In upriver areas no longer accessible to anadromous fish, these game fish populations have a special economic and recreational importance. Bonneville in 1986 funded 14 studies on these species, their food and habitat preferences, reproductive success, and their response to conditions in rivers above and below dams.

Water levels can sometimes fluctuate daily at the huge reservoirs behind Kerr, Hungry Horse, and Libby Dams, where several Bonneville projects to protect resident fish are underway. Among species being monitored are kokanee (a race of landlocked sockeye salmon), Dolly Varden or bull trout, westslope cutthroat trout, northern pike, largemouth bass, yellow perch, and lake and mountain whitefish.

These non-migratory fish normally nest in shallow shoreline areas. But in winter months at times of peak power demand, falling water levels can leave their eggs high and dry and exposed to lethal frosts. Fluctuations also erode the lakeshore and filter silt into spawning gravels, suffocating eggs and fry. Falling water levels can destroy shallow vegetation that serves as food and shelter for young fry, and may also affect production of the aquatic organisms that all fish feed on.

OPPOSITE: Cabinet Gorge, Sandpoint, Idaho: Plastic cylinders keep kokanee eggs isolated while they incubate, preventing the spread of disease. BRYAN PETERSON

Upriver Game Fish: Project Descriptions

Effects of Operation of Kerr and Hungry Horse Dams on Reproductive Success of Kokanee in the Flathead System (81-105)

Lower Flathead Fisheries Study (83-1)

Columbia River White Sturgeon Life History and Genetics Study (83-316)

White Sturgeon Research Program Development (85-64)

Determine the Status and Habitat Requirements of White Sturgeon Populations in the Columbia River Downstream from McNary Dam (86-50)

Evaluation of Management for Water Releases for Painted Rocks Reservoir, Bitterroot River, Montana (83-463)

Quantification of Hungry Horse Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries (83-465)

Quantification of Libby Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries (83-467)

Cabinet Gorge Kokanee Hatchery (84-19)

Kokanee Stock Status and Contribution of Cabinet Gorge Hatchery (85-339)

Engineering Evaluation of Cabinet Gorge Kokanee Hatchery (86-120)

Study of Instream Flows Needed to Mitigate Trout Impacts of Libby Dam (85-6)

Determination of Resident Fishery Losses in Tributaries of the South Fork Flathead River (85-23)

Colville Tribal Hatchery Pre-design (85-38)

Effects of Operation of Kerr and Hungry Horse Dams on Reproductive Success of Kokanee in the Flathead System (81-105)

Kokanee, a landlocked race of sockeye salmon, make up almost 90 percent of the total game fish harvest in Montana's Flathead Lake, but their numbers had been rapidly declining since the late 1970s. Biologists believe that reduced spawning by the lake shoreline and in the mainstem Flathead River is caused largely by the operation of Kerr and Hungry Horse dams.

Montana Department of Fish, Wildlife and Parks is studying what flows from these dams will optimize spawning, incubation, and rearing conditions for kokanee in the upper Flathead River and lake with the least impact on power production. Recommended flows have been achieved with the cooperation of Bonneville and the Bureau of Reclamation, and evaluation continues through December 1987.

The project team last year completed a final research report for the river portion of the study. MDFWP has taken several steps to ensure the recovery of kokanee populations, including a reduction in catch limits and a ban on snagging kokanee throughout the drainage. Researchers in 1986 began investigating zooplankton and mysid shrimp abundance in Flathead Lake and the potential impact on kokanee levels. The final project report is due in 1988.

Lower Flathead Fisheries Study (83-1)

Researchers from the Confederated Salish and Kootenai Tribes of the Flathead Reservation continued to document how resident fish species in the Lower Flathead River are affected by the operation of Kerr and Hungry Horse Dams. Stocks being surveyed are trout, northern pike, largemouth bass, yellow perch, and lake and mountain whitefish.

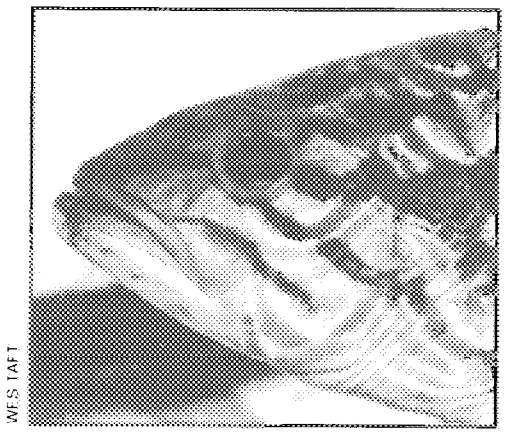
The study is investigating possible alternative ways to manage and protect the tribal fishery resource, including regulating sport and subsistence fishing and controlling the development and operation of new and existing hydro facilities. The project team will also recommend ways to make up for past fish losses at the dams. One possibility being considered is to increase the amount of quality aquatic habitat to encourage game fish propagation.

Field work continued through 1986 and a final report will be published at the end of 1987. Since it is largely non-Federal hydro operations and irrigation development that affect fish resources here, Bonneville does not plan further involvement in the Lower Flathead System once this project is complete. The Tribes, Montana Department of Fish, Wildlife and Parks and Montana Power Company will select, implement, and manage mitigation measures.

Columbia River White Sturgeon Life History and Genetics Study (83-316); White Sturgeon Research Program Development (85-64); Determine the Status and Habitat Requirements of White Sturgeon Populations in the Columbia River Downstream from McNary Dam (86-50)

Hydroelectric dams throughout the Columbia River Basin now block the ancestral migratory routes of white sturgeon, a mysterious, ancient species of resident fish struggling to adapt to a greatly changed habitat. Biologists think this altered environment has changed the sturgeon's behavioral pattern, but they know little about the species' basic biology.

A University of Washington study (83-316) is gathering life history information that will help identify what environmental changes most affect the sturgeon. It is investigating the responses of young fish to changes in water temperature, flow, and other variables. The study is also identifying genetic distinctions among populations and whether stock supplementation is feasible. Results will be used in designing programs to offset sturgeon losses.



WES TAFT

Smallmouth bass.

The team in 1986 almost completed early life history studies in the School of Fisheries laboratory, documenting behavioral patterns and food requirements for juveniles. Genetic assessment studies were expanded to include more sampling in the Upper Columbia, particularly in Lake Roosevelt. The project continues through 1990.

Battelle Pacific Northwest Laboratory, with input from the fisheries agencies, Tribes, universities, and the private sector, completed a comprehensive research plan for white sturgeon in the Columbia Basin (85-64). The plan identifies all completed and ongoing research projects, coordinates research planning efforts in the region, and establishes an information clearinghouse on the white sturgeon.

In a new project launched in 1986, biologists from Oregon Department of Fish and Wildlife, Washington Department of Fisheries, National Marine Fisheries Service, and U.S. Fish and Wildlife Service are evaluating the sturgeon's physical habitat requirements (86-50). They will describe its reproduction, early life history, and population dynamics, then define its spawning and rearing needs, and finally recommend ways to enhance populations.

The study began with a literature search and the creation of models to predict the effects of dam-related habitat disturbances. Field workers will next take sturgeon samples from the Dalles Pool and from below Bonneville Dam.

Evaluation of Management for Water Releases for Painted Rocks Reservoir, Bitterroot River, Montana (83-463)

Montana Department of Fish, Wildlife, and Parks in 1983 started preparing a water management plan to enhance trout spawning and rearing in the Bitterroot River, a tributary of the Clark's Fork of the Columbia River in Western Montana.

The agency has monitored many aspects of the Bitterroot River, including water temperature, stream discharge, water quality, and irrigation withdrawals. The project has also analyzed the area's salmonid fish habitat and monitored brown and rainbow trout spawning activities to better define population and habitat requirements.

MDFWP researchers studied the feasibility of scheduling water releases at Painted Rocks Reservoir to increase trout populations, at present limited by low summer water levels. In 1986, they further refined the timing of water releases and sponsored a series of educational meetings with irrigators, who divert much of the Bitterroot in the summer.

A major 1986 milestone was the announcement by Montana Power Company that they will purchase the water from Painted Rocks for fish flows in perpetuity. The water management plan will be ready in early 1987, and MDFWP will put it into effect next summer.

Quantification of Hungry Horse Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries (83-465); Quantification of Libby Reservoir Levels Needed to Maintain or Enhance Reservoir Fisheries (83-467)

Biologists from Montana Department of Fish, Wildlife, and Parks are studying the effects on resident game fish of water releases for power generation, flood control, or other water management activities in Hungry Horse and Libby reservoirs. Maximum drawdown at Hungry Horse reservoir, for example, can reduce water volume by over 60 percent, causing food and habitat problems for important game species such as the westslope cutthroat trout.

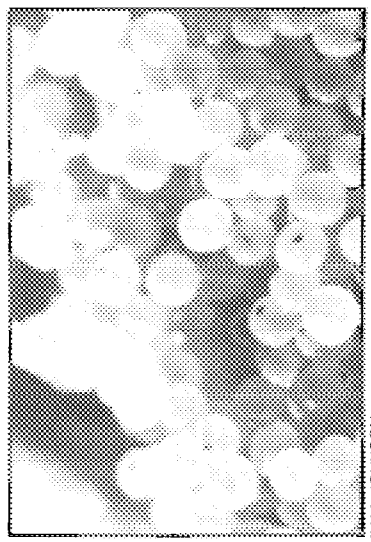
In 1986, researchers continued collecting data on the the amount of reservoir habitat available at different water elevations, patterns of habitat use by major game species, and availability and consumption of food organisms.

The data will enable scientists to predict the effects of hydro operations on resident fisheries and recommend seasonal drawdown levels that are compatible with the needs of the fish. Field studies continue through fall 1987, while simulation models and final reports are expected by 1988.

Cabinet Gorge Kokanee Hatchery (84-19); Kokanee Stock Status and Contribution of Cabinet Gorge Hatchery (85-339); Engineering Evaluation of Cabinet Gorge Kokanee Hatchery (86-120)

Albeni Falls and Cabinet Gorge dams are partly responsible for a steep drop in the kokanee population in Lake Pend Oreille, northern Idaho. When biologists released an exotic species of shrimp as food to rebuild the kokanee stock, they found the shrimp instead competed with the small fish for food supplies. Combined impacts have reduced the annual Lake Pend Oreille kokanee catch from 1 million to 200,000.

To compensate for these losses, a hatchery was built downstream of the Cabinet Gorge Dam on the Clark Fork River, one of the lake's tributaries (84-19), to produce 20 million kokanee fingerlings per year. Funding came through a 3-party cooperative agreement; Bonneville and Washington Water Power each provided half the cost of design and construction, while Idaho Department of Fish and Game funds operation and maintenance.



DALE JOHNSON

Cabinet Gorge, Sandpoint, Idaho: The new hatchery will incubate 30 million kokanee eggs and release 20 million fry each year.

Construction was completed in November 1985, a year ahead of schedule. In July 1986, officials released the first fingerling into the Clark Fork River. Biologists predict there will be up to 1 million more kokanee in the lake in 3 to 5 years. The hatchery could produce a third of all Idaho's hatchery fish.

IDFG is conducting a separate study to evaluate what contribution the new hatchery will make to the kokanee fishery in Lake Pend Oreille (85-339). They estimate population size, age composition, and the proportion of wild to hatchery-reared fish, and also compare growth and survival rates to population density and the carrying capacity of Lake Pend Oreille. Work will continue through 1989.

Another IDFG team started evaluating the effectiveness of the design and layout of the hatchery (86-120). Studies of several component systems were completed in 1986, including the metal building, hydraulic system, and electrical system. Also evaluated were construction methods, manpower requirements, and different methods of sealing the bottom of the effluent pond. The study concludes in 1987.

Study of Instream Flows Needed to Mitigate Trout Impacts of Libby Dam (85-6)

The Kootenai River supports one of western Montana's most popular trout fisheries. A dense population of wild rainbow trout, most of them resident fluvial fish bred from native and hatchery stocks, inhabits the 50 miles of river from Libby Dam to the Idaho border. Migratory fish also reside in the Kootenai River but mostly spawn in tributary streams. Lake Koocanusa, the reservoir behind Libby Dam, also supports populations of rainbow and cutthroat trout and kokanee salmon, which all use the tributaries for spawning and/or rearing.

In this study, which concluded in 1986, Montana Department of Fish, Wildlife and Parks determined levels of instream flows required to ensure successful migration, spawning and rearing of salmonids in 5 tributaries of the Kootenai River and 6 tributaries of Lake Koocanusa. Several of these sites are targeted for micro-hydro development, and irrigation diversions exist on at least 2 streams.

Determination of Resident Fishery Losses in Tributaries of the South Fork Flathead River (85-23)

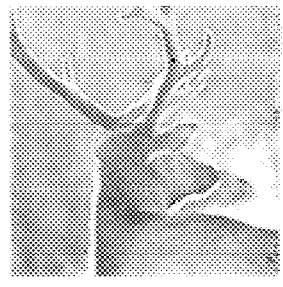
Construction of Hungry Horse Dam in 1951 flooded some 35 miles of the South Fork Flathead River and portions of about 50 tributary streams, eliminating large areas of trout spawning and rearing habitat. The dam also blocked access to about 40 percent of the drainage area available for spawning salmonids migrating upstream from Flathead Lake, isolating migratory species such as the westslope cutthroat, bull trout, and mountain whitefish.

MDFWP continued work on this study to estimate resident fish losses as a result of Hungry Horse Dam and propose ways to rehabilitate the fishery. The project team coordinates closely with two other studies being conducted at Hungry Horse reservoir (81-105 and 83-465).

Colville Tribal Hatchery Pre-design (85-38)

The Colville Tribe last summer completed the preliminary design for a resident trout hatchery on their reservation. Bonneville is coordinating planning, design, and construction of the facility with representatives of the Colville Confederated Tribes and Federal, state, and local agencies. The project will partially mitigate for anadromous fish losses due to the hydro system.

The study team developed a detailed hatchery plan, including preliminary layouts and drawings, cost estimates, selected alternatives, conclusions, and recommendations. The final design is due in 1987, and construction will be completed the following year. The Colville Tribe will operate the hatchery with Bonneville funds.



Wildlife

Biologists are studying with great interest a growing colony of bald eagles which has established a wintering area near Lake Pend Oreille in Idaho. Ironically, it is another unrelated Bonneville-funded project that serves as the attraction for this endangered species.

A new kokanee hatchery at the lake, which went into operation a year ago, has brought some 60 eagles to the area to feed on fish that die after spawning in Lake Pend Oreille and the Lower Clark Fork River. Their number could easily increase to several hundred because of the abundant food supply, so biologists are trapping and tagging birds to monitor how the hatchery will affect them.

The bald eagle is only one wildlife species experiencing the effects of an altered natural habitat due to hydroelectric development, though in its case the effects are benign and even positive.

Reservoirs have permanently inundated former floodplain and riparian habitat for several less fortunate species. Frequent fluctuations in water levels leave streamside areas bare, dangerously exposing animals and wildfowl on their way to the water's edge to predators and other hazards.

One example is a large flock of Canada geese which lives year-round in the Flathead Valley, one of its major North American breeding grounds. But the operation of Hunrgy Horse and Kerr dams causes extreme fluctuations in water levels. Scientists are evaluating how the dams affect nesting habitat, nesting success, and gosling survival. The study will help determine how best to manage the large wild goose population given the existing water level constraints.

The availability of wintering range is an important factor limiting big game populations. Much rangeland was lost when rivers suddenly became lakes. But it is the quality of grazing lands that ultimately ensures the survival of threatened species like one of Montana's last remaining native populations of bighorn sheep.

These animals spend spend their summers on high mountain slopes within the national parks and the wilderness areas of national forests. In winter, deep snows cover their pastures and force them down to the valleys. There, the available vegetation is low in essential nutrients.

The malnourished animals are weak and vulnerable, especially females who give birth in the spring. Lack of a high-protein diet for lactating females is directly tied to offspring mortality. Bonneville funded 2 projects to save this last remnant of western Montana's native bighorn, which until recently was close to extinction. Forest Service crews are seeding new grass stands and rejuvenating existing grass and shrub areas by slashing, burning and fertilization.

In 1986, Bonneville funded the following studies to address wildlife concerns.

OPPOSITE: Bitterroot Valley, Montana: Bull elk in velvet, just before the rut. BRYAN PETERSON

Wildlife: Project Descriptions

Impact of Water Levels on Canada Geese (83-2)

Impacts of Water Levels on Productivity of Canada Geese in the Northern Flathead Valley (83-498)

Willamette River Projects Wildlife Loss Assessments (84-36)

Willamette River Projects Wildlife Mitigation Plans (86-64)

Ural-Tweed Bighorn Sheep Wildlife Mitigation Projects (84-38, 84-39)

Wildlife and Wildlife Habitat Loss Assessments for the Anderson Ranch, Black Canyon, and Boise Diversion Hydroelectric Facilities in Idaho (85-1)

Upper Snake River Projects Wildlife Mitigation Plans (86-73)

Cabinet Gorge Eagle Study (86-14)

Grand Coulee Dam Wildlife Mitigation Plan (86-74)

Impact of Water Levels on Canada Geese (83-2); Impacts of Water Levels on Productivity of Canada Geese in the Northern Flathead Valley (83-498)

A flock of 2,500 Canada geese live year-round in the Flathead Valley, one of the species' major breeding areas in North America. But the construction and operation of Hungry Horse and Kerr dams has affected water levels. Extreme fluctuations may be exposing these wildfowl to predators and other hazards.

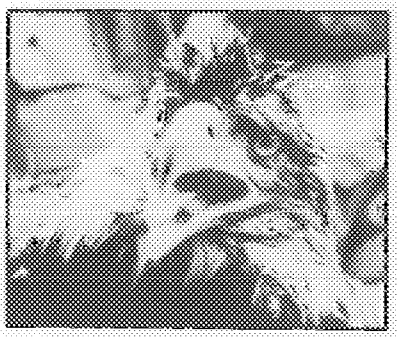
Biologists working for the Confederated Salish-Kootenai Tribes are studying Canada geese on the south half of Flathead Lake and the lower Flathead River (83-2). In 1986, they continued evaluating how the operation of Kerr and Hungry Horse dams affects nesting habitat, nesting success, and gosling survival. The team concluded field work and is currently analyzing data and formulating recommendations for protecting the wild geese. A final report is due in July 1987.

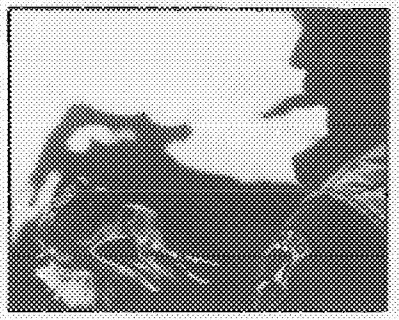
On the north shore of the lake and on the upper Flathead River, Montana Department of Fish, Wildlife, and Parks, in a related study (83-498), is inventorying Canada goose nesting and brooding habitats and evaluating nesting success and gosling survival. The study will help biologists determine how best to manage the goose population under given water level constraints.

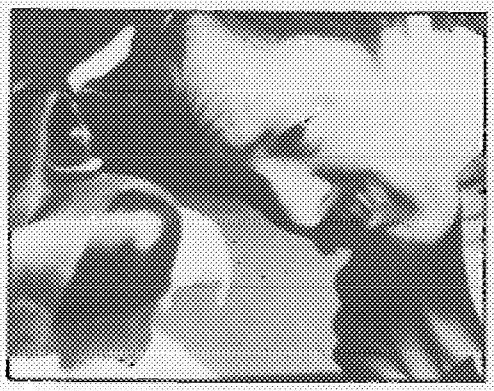
Field workers completed data collection in 1986. The study team is completing a final report, including recommendations for protecting the geese, to be published in August 1987.

BRYAN PETERSON

McDonald Creek, Glacier National Park, Montana: As many as 600 bald eagles show up each year to feast on the creek's kokanee.







Lake Pend Oreille, Idaho. A biologist catches a bald eagle to band and tag it with a radio transmitter. The study will tell how the eagle population reacts to the lake's new kokanee hatchery. SHARON BLAIR

Willamette River Projects Wildlife Loss Assessments (84-36); Willamette River Projects Wildlife Mitigation Plans (85-64)

Oregon Department of Fish and Wildlife researchers in 1986 completed this study to assess how the construction and operation of hydro facilities has impacted wildlife around the Federal Willamette River hydroelectric facilities in Oregon.

Researchers have estimated losses to populations and habitat through inundation caused by 6 hydro projects — Cougar Dam (South Fork McKenzie River), Lookout Point Dam, Dexter Dam, and Hills Creek Dam (Middle Fork Willamette River), Green Peter/Foster Dams (Middle Santiam River), and Detroit/Big Cliffs Dams (North Santiam River).

The final report identified losses to target wildlife species and their habitat. A separate mitigation plan is being prepared which will recommend wildlife habitat mitigation and enhancement opportunities for the Willamette River Projects (86-64).

Ural-Tweed Bighorn Sheep Wildlife Mitigation Projects (84-38, 84-39)

Two 5-year projects focus on halting the drastic decline in numbers of a race of bighorn mountain sheep called the Ural-Tweeds. All that remains is a small herd, the last remnant of western Montana's native population of bighorn, which until recently was dangerously close to extinction after dwindling for the past 20 years. The impoundment of the Kootenai River by Libby Dam deprived the Ural-Tweeds of vital areas of spring and winter range. The filling of the Lake Koocanusa reservoir inundated some 4,350 acres of rangeland.

The U.S. Forest Service's Kootenai National Forest, through project 84-38, is improving existing habitat conditions by seeding new grass stands and by rejuvenating existing grass and shrub areas in poor condition by slashing, burning and fertilization.

MDFWP, in project 84-39, monitors herd responses to the improved vegetation, which eventually will cover some 1,300 acres of critical spring and winter range. The herd now numbers around 50 — up from 25 a few years ago.

Wildlife and Wildlife Habitat Loss Assessments for the Anderson Ranch, Black Canyon, and Boise Diversion Hydroelectric Facilities in Idaho (85-1); Upper Snake River Projects Wildlife Mitigation Plans (86-73)

Idaho Department of Fish and Game completed a study to estimate losses to wildlife and wildlife habitat resulting from the construction and operation of the Anderson Ranch, Black Canyon, and Boise Diversion hydro projects in the Upper Snake River drainage (85-1).

Data collected will help define projects to protect and enhance affected wildlife in the area to make up for the adverse impacts of the facilities. Work got underway in 1986 on a wildlife plan for Palisades Dam on the South Fork Snake River, and in 1987 IDFG will develop a mitigation plan for the Black Canyon and Anderson Ranch (86-73).

Cabinet Gorge Eagle Study (86-14)

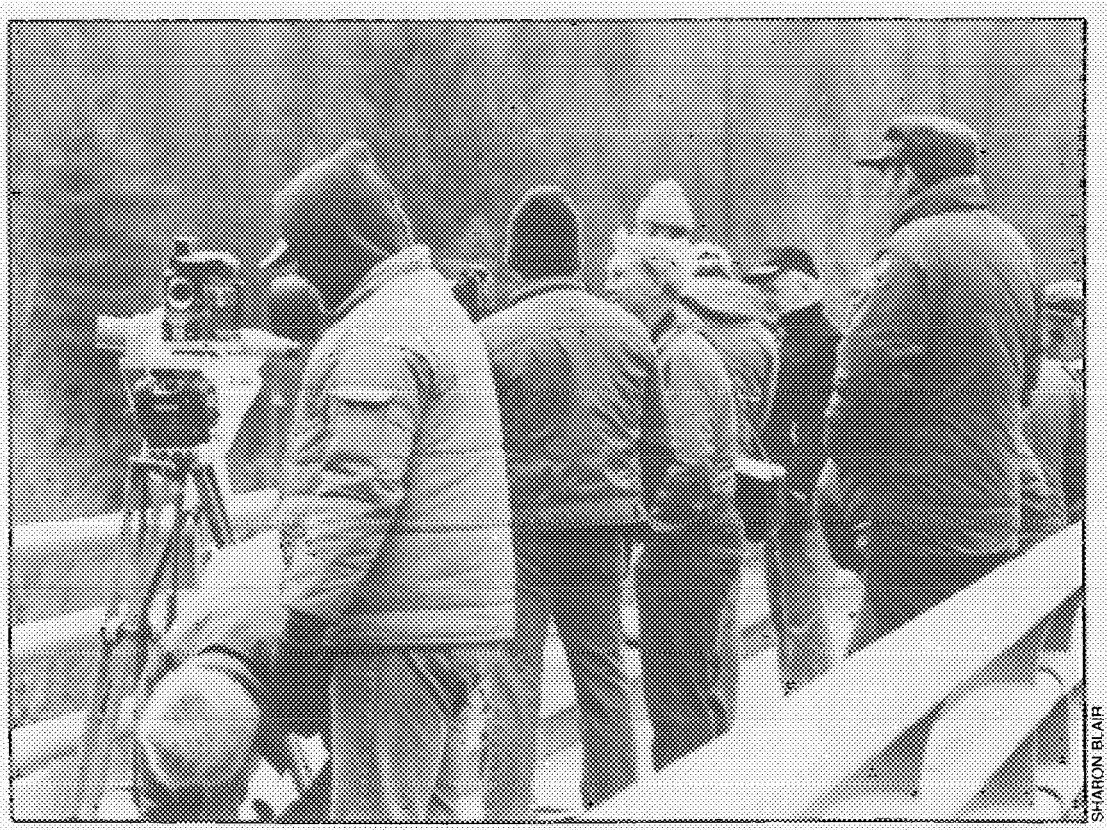
The new kokanee hatchery completed in late 1985 at Lake Pend Oreille, Idaho, has the potential to create a major wintering area for bald eagles, a Federally listed endangered species. Currently, some 60 eagles live in the area, and biologists estimate this number could increase to several hundred due to the availability of prey. Eagles feed on dying kokanee after they have spawned in the lake and the Lower Clark Fork River.

Biologists have trapped and tagged 16 birds with radio transmitters, to find out more about how eagles use Lake Pend Oreille and how the new hatchery will affect them. They are tracking the eagles and mapping their movements and identifying preferred habitat areas, feeding locations, and selection of prey.

Grand Coulee Dam Wildlife Mitigation Plan (86-74)

Washington Department of Game biologists, in cooperation with the Spokane and Colville Indian Tribes and other agencies, have completed a protection, mitigation, and enhancement plan for wildlife species affected by Grand Coulee Dam.

The goal is to protect or replace approximately the same amount of habitat that was lost through inundation — some 70,000 acres. The proposal calls for acquisition of title or rights to suitable land, improvement of acquired lands to preserve selected wildlife species, and enhancement of habitat suitable for bald eagles.



SHARON BLAIR

McDonald Creek, Glacier National Park, Montana: Each year some 65,000 people come to watch the salmon/eagle rendezvous.

OPPOSITE: Willamette Valley, Oregon: Biologists are looking for ways to make up for wildlife habitat lost to hydro development. BRYAN PETERSON